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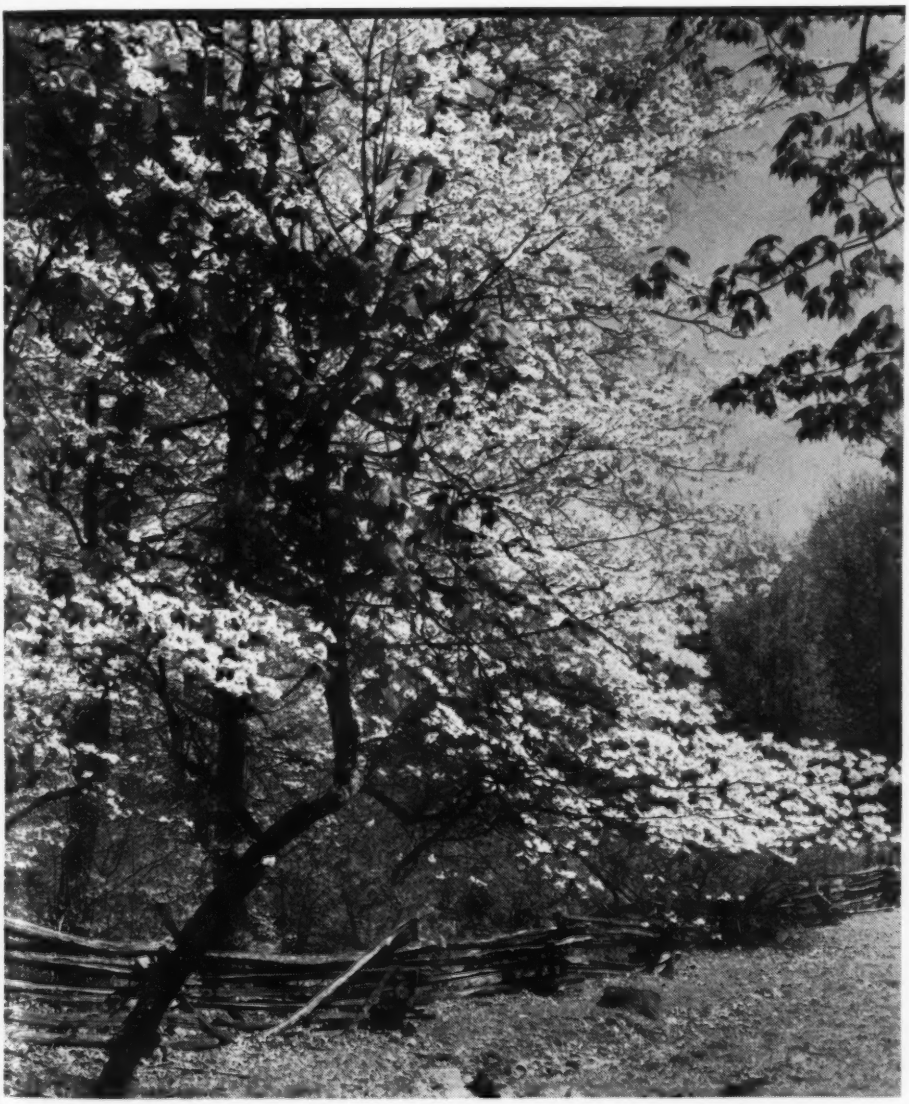

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R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXI NO. 4

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ONE OF THE "IN-BETWEEN" JOBS ON A FARM

Better Crops with PLANT FOOD

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VOL. XXXI WASHINGTON, D. C., APRIL 1947 NO. 4

Uncle Sam is . . .

Making It Safer to Save

Jeff McDermid

BECAUSE so many battle-fever booms have blown up in a grand bust sooner or later, one senses a steady undercurrent of unrest and vague conjecture these days, both in the city offices and out on the land. To some extent this perplexity grooves into a measurement of what a fellow's got laid by in reserve against the normal hazards of life, either with or without the extra strain of "hard times." It has been said on frequent occasions that people seldom remember their reverses when they are enjoying gilt-edged prosperity, but this time I have a sneaking feeling that memories are longer and caution is somewhat more evident. And what makes this taking of our reserve inventory still sounder all this while is the fact that if nothing bad happens to us a streak of advance financial planning can't hurt us in the least.

Any question of thrift hitches right up to one's general attitude toward the earthly future, and saving is usually more satisfying if you know why your relations and the whole country are better off every time you make a sound investment and stick to it.

After some time spent in observation and cogitation, my hunch is that, by and large, the social and economic focus of the farmer is fixed on "parity" while that of the average city worker rests on "security." Let's pass up the old slide-rule approach to the hoary debate on parity formulas and just look at it solely for its own sake—as a word fraught with a certain class-conscious meaning. Farm folks have seldom been as much concerned with future social security in the city man's sense, as they

have been with the equality fetish. This is the ingrown desire to be treated as well and as fairly as their own neighbors, or the adjacent community, or some distant metropolis.

Independence and self-reliance, improvising and pioneering, have been the basic lot of farmers, and they naturally have set up lines of thought that persist even in these modern days of thinner social walls between town and country. Farmers have sort of had a chip on their shoulders for generations in respect to their right to equality of education, privileges, civic rights, favors, class recognition, and net income, and to be treated shabbily or to be overlooked entirely was deemed an insult.

THEY expected nothing free (except the weather) and did not ask for coddling. But they darned well insisted that the march of progress should not tramp on their bunions and that the rural phalanx ought to march up front with the other big-shot delegation and carry just as bright flags past the reviewing stand.

Your city objective bore instead a mass demand for security in various ways and through sundry means—hours of labor, rates of pay, seniority of employment, union recognition, sanitary surroundings, unemployment benefit, old-age, hospital, sickness and bank deposit insurance, as well as certain forms of cooperative comforts, benevolences, and safeguards. The city was thinking of the hired man, the daily wage-earner, not the employer so much. The farmer was often unaware that the agricultural hired class had any vexations, any grievances, or any regrets. The sky was usually so blue, the air so fresh and invigorating, and the society so wholesome that a guy might even work out there for the fun of it, almost —like those city slickers who camped out sometimes on 15 acres.

The farmer shied away from any mass reforms or storm-cellar protective ideas. Even his farm co-ops were concerned mostly with getting equality (parity) for processed merchandise, at the risk of bidding up the market to get it, and so thought little about saving the individual farmer from woe and want.

It is quite easy to see why the farmer's ideals tended in that direction. Work was always staring him smack in the face the year round and jobs were usually extra plentiful. Above all, however, his reliance for a family legacy or for old age was largely in the acres he operated and their chance of becoming more valuable. We must admit that for sharecroppers and professional tenants no such picture can be painted. In many ways their needs resembled the security outlook of the city workman.

Since the second world war began I've noticed a strong leaning by many farmers toward the future welfare of themselves and their children, which has become manifest in other ways than the "jealous minded" shibboleth of "parity." They stick to the equality plank in their platform, but they are measuring the job for a new timber soon to be wedged in and bolted down fast, as a sort of springboard for the days and the years to come.

From here, that new stringer in the foundation looks suspiciously like it might have grown in the big woods of "security." It has at any rate altered their investment ideas in a big way. Where increase in the productivity and sale advantages of their farms used to be the mainspring of future investment hopes, and the old sock and the country bank once took all their ready cash, we note a shift to government bonds and life insurance policies. This means that somebody has been thinking a little mite differently and then acting on the new hunch.

I KNOW there are very many exceptions. I saw a farmer in 1943 haul out his wallet and ask his wife for hers, and together they unreeled several thousand smackers for a farm they thought they wanted. I know savings bond sales crews that can tell hoarding

yarns to end all miserly romances. But I am reporting the average situation here and insist that it isn't considered cute and sharp any longer to hide your whole income in some obscure and unsafe cache, like the squirrel or the chipmunk.

Early this year a leading Midwest farm journal sought the opinion of its readers as to whether they chose to pay

less income taxes or whittle down the national debt—which now represents about $2,000 per capita and equals $180 for every $100 of annual national income. In general the response made by these farm thinkers shows a heavy majority in support of debt reduction as opposed to tax relief. It squares with their other sound program for heading off monetary inflation, which consists of widespread farm buying of gilt-edge savings and coupon bonds.

Evidently our farm neighbors have been wiser in the lore of public finance than many of us gave them credit for. It is noticeable that a plentiful supply of currency which increases faster than the national income or the supply of goods simply sets the stage for a price-kiting spree and a subsequent headache when the bubble bursts.

Smart financial doctrine backs up the rural opinion survey just mentioned, because it would be safer to transfer more of the government obligations from commercial banks and distribute them out among ordinary thrifty citizens of small means. As long as the present good rule obtains, which says that U. S. savings bonds are not saleable or tradable or useful as collateral or for speculation, just so long will we tend to escape the loss of investment and loss of confidence that followed when the liberty bond issues of the other world war were used like legal tender and negotiated at will.

Farmers know this, because I heard one of the leaders of a local co-op state with vehemence that any move to pay off the war veterans with a special government bond issue, freely negotiable by the holders, would be the worst blow which a grateful bunch of politicians could strike at the heroes of yesterday. And we might add, its effects would be chaotic to the rest of us, who wish the veterans well in a sure-footed but old-fashioned economic way, rather than to hand them a quick bonus for a fast ride to ruin.

Farmers are encouraging their sons, who have joined them once more on the old acreages, to trim their sails against future storms by a reasonable investment in capital improvements and better farm equipment, plus a margin kept for emergencies in the form of reliable U. S. savings bonds. Three years ago it was pure patriotism that outwardly swung farmers toward government bond buying, but inwardly and in a practical sense, those documents that crinkled and crackled in their hands were passports to security.

IN THE recent era of gore and glory which rocketed our national debt into the stratosphere, many of the big agricultural states formed vigilant committees to be on guard against panhandlers and speculative boomers. This defensive body was ably aided in a sound and positive way by an offense army out in the fields. There were alert and public-spirited teams who volunteered to hit the back roads and by-paths so as to reach those war-wealthy farmers before they were buttonholed and buncoed by the slippery slinks who urged the buying of more land, more oil wells, more sugar, fur and rubber bonanzas, and more

(*Turn to page* 49)

Fertilizers for Sugar Beets

By R. L. Cook

Soil Science Section, Michigan State College, East Lansing, Michigan

THE sugar beet crop is one which necessitates a relatively high cash investment. The crop is grown on the best soil. Compared with other crops grown on the same farms, labor costs for beets are high. The market value of a good crop is relatively high, but with such a high cash investment a poor crop may be produced at a loss. Thus it seems more important with beets than with other crops that every effort be expended to produce as much sugar per acre as is possible. This is especially true with sugar scarce throughout the world.

It is essential that every grower study his soil carefully and be sure he is prepared to apply just the right fertilizer when he goes into his field to plant. Several phases of sugar beet fertilizer usage for the Eastern area may well be reviewed at this time. Most growers are not applying enough fertilizer. Others are using inefficient methods of application. Many are applying mixtures not adapted to their particular soil.

In most cases a complete fertilizer is desirable. In an experiment conducted on a Miami silt loam in Tuscola County, Michigan, the highest average yield over a five-year period was obtained from plots treated with 4-16-8 fertilizer. Even though the experiments were on a farm where the soil received manure in the rotation, the fertilizer containing potash (0-14-6) yielded, as an average, slightly more than 1¼ tons per acre more than did plots which received only superphosphate (0-16-0). The rate of application was 400 pounds in all cases.

Sugar beets require large quantities of potash. A 16-ton crop, with the tops which would weigh an additional 4 tons, would contain according to analyses recorded by Morrison (Feeds and Feeding) over 150 pounds of K_2O. From those figures it is easy to see why it is so necessary to include potash in the sugar beet fertilizer.

On the heavier upland soils, 2-16-8 can generally be recommended. If the soil is somewhat lighter, classifying as a loam or perhaps a heavy phase sandy loam, or if the organic-matter content runs rather high in spots, it may be better to apply such a mixture as 3-12-12.

Rate of Application

The rate of fertilizer application could profitably be increased on most farms. Many experiments have shown this to be true. In the Ferden rotation experiment, located near Chesaning, Michigan, in Saginaw County, one-half of each plot receives fertilizer at the rate of 1,000 pounds per acre during the rotation, while the other half receives only 400 pounds. In each case, one-half the total amount goes on the beets, in a band beside the row. The experiment has now been in progress for six years and each year the additional amount of fertilizer has resulted in greatly increased yields in all rotations. The average yields for the past five years are presented in table 1. In all seven rotations, varying with respect to sequence of crops and kind of crops, the more heavily fertilized plots yielded more than did those which received the lighter application.

Analysis of the data showed that the response of the beets to the greater amount of fertilizer did not vary among the different rotations, but it did vary from year to year. The 1945 results are

illustrated in figure 1. When the plots in all rotations are averaged for the five years, the difference in yield in favor of the extra fertilizer is 1.57 tons per acre, a very good return for the extra investment.

One of the ways that fertilizer helps sugar beets is in improvement of stand. When the fertilizer is placed close to the seed at planting time, the young plants actually emerge quicker and make a faster, more thrifty growth. Naturally, seedling loss from disease or adverse weather conditions is less when the plants are thrifty. For several years, stand-counts on experimental plots on the Bobit farm near Breckenridge showed that better stands resulted on fertilized plots than on those not fertilized. The counts were taken soon after the beets were blocked. As shown by the data reported in table 2, improvement in stand occurred each year. In 1943, the number of plants on the fertilized plots was almost three times the number on the unfertilized plots.

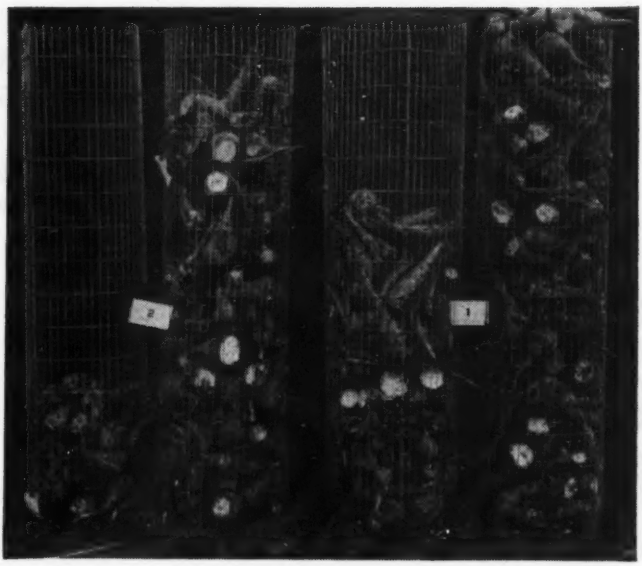


Fig. 1. Sugar beets need plenty of fertilizer. The two pairs of cylinders represent the 1945 yields from rotation 1 and 2. The smaller yield in each pair is from the side of the plot which received 200 lbs. of 2-16-8 fertilizer when the beets were planted, and the larger quantity is from the side which received 500 lbs.

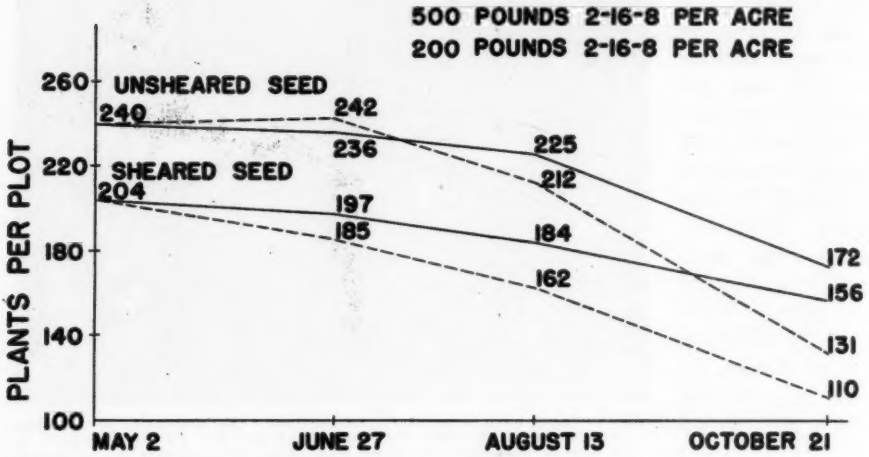
TABLE 1.—THE EFFECT OF HIGH VS. LOW APPLICATIONS OF FERTILIZER ON THE YIELD OF SUGAR BEETS ON THE FERDEN ROTATION EXPERIMENTAL FIELD. BROOKSTON CLAY LOAM SOIL.

Rotation	Tons beets per acre	
	High fertilizer[1]	Low fertilizer[2]
1	10.34	8.68
2	10.88	9.16
3	10.24	9.02
4	10.45	8.59
5	10.04	8.60
6	9.64	7.93
7	10.08	8.69
Average	10.24	8.67

[1] 500 pounds 2-16-8 on beets, 1,000 pounds in rotation.
[2] 200 pounds 2-16-8 on beets, 400 pounds in rotation.

The effect of fertilizer on the stand of sugar beets on the Ferden plots in 1945 is shown graphically by figure 2. Counts were taken separately on the two halves of each plot which had been planted to two kinds of seed, sheared and unsheared. From both kinds of seed the loss of plants as the season progressed was greater on the plots which received the smaller amount of fertilizer. This is shown by the fact that the curves get farther and farther apart. It is interesting to note that while the stands at the beginning were much better where unsheared seed was planted, the final stand from sheared seed on the heavily fertilized plots was higher than from unsheared seed on the

FIGURE 2
EFFECT OF SHEARING SEED ON FERTILIZER RESPONSE AND EFFECT OF FERTILIZER RATE ON STAND



plots which received the smaller amount of fertilizer.

Another interesting observation is evident from these curves. The response of the beets to fertilizer, as evidenced by stand, was greater where sheared seed was planted than where the seed was unsheared. This is shown by the fact that the spread between the curves is greater for sheared than for unsheared seed. This fact was most noticeable in the field at the time the August 13 counts were made.

On that date there was a difference of 13 in the counts from the unsheared seed as compared to a difference of 22 in the counts from the sheared seed. This difference is significant. Also at that time there appeared to be more difference in top growth between the low- and high-fertilized sides of the plots where the beets were from sheared seed than where they were from unsheared seed. This is probably due to the fact that the lesser disturbed plants from the sheared seed were able to make better use of the fertilizer.

Another soil fertility problem which should be considered is that of the need of sugar beets for nitrogen. The crop needs plenty of this important plant food. This has been shown by experiments in the greenhouse and in the field and by many observations and plant-tissue tests throughout the Michigan area. These experiments and observations indicate that it may be possible for the crop to obtain sufficient nitrogen from decomposing alfalfa provided it has not been over one year since the alfalfa was plowed under. Where sugar beets are to be planted on fields where alfalfa, clover, or sweet clover

TABLE 2.—THE EFFECT OF FERTILIZER ON STAND OF SUGAR BEETS. BROOKSTON SILT LOAM SOIL.

Treatment	Beets per 400 feet of row				
	1936	1937	1938	1939	1943
None	278	387	318	316	104
300–2–12–6	343	399	360	339	.....
400–2–16–8	.....	.....	.....	.....	280

has not been plowed under during the last year, it may be profitable to apply some extra nitrogen as a side-dressing during the growing season. Nitrogen, applied after the beets show signs of nitrogen starvation, may be very profitable. The results presented in table 3 compare the effects of alfalfa and commercial nitrogen, in the form of ammonium sulfate, on beet yields. The experiments were on two different farms but the results are interesting, nevertheless. On the Ferden farm, sugar beets following corn which followed alfalfa have averaged over a five-year period 9.52 tons per acre as compared to a yield of 8.79 tons where beets followed corn but where there was no legume in the rotation.

TABLE 3.—SUGAR BEETS NEED PLENTY OF NITROGEN

Lee Ferden farm—5-year average—
Brookston clay loam

Treatment	Tons beets per acre
One year alfalfa in rotation...	9.52
No legume in rotation.....	8.79

Elmer Rader farm—1945—
Brookston clay loam

No fertilizer.....	7.35
375 pounds ammonium sulfate applied as side-dressing.	8.43

On the Rader farm, beets in 1945 following three years of combined grain showed marked symptons of nitrogen starvation. They were side-dressed with ammonium sulfate at the rate of 375 pounds per acre on August 17. The color of the foliage had improved enough to photograph on September 4 and the final increase in yield was slightly over one ton per acre. Had the application of nitrogen been earlier, the increase in yield might have been still greater. This fact that sugar beets need plenty of nitrogen is not a recent discovery. Tyson and McCool* in 1930 reported very profitable results from applications of 300 pounds of sodium nitrate per acre.

Manganese Is Needed on Alkaline Soils

If soils which are to be planted to sugar beets have a pH higher than 6.8, or in other words if they are neutral or alkaline, it is advisable to apply fertilizer containing manganese sulfate. This recommendation is based on experimental results, soil tests, and observations made during the past four years. When soils are alkaline, the manganese is tied up in a form too slowly available to meet the requirements of sugar beets. This results in a light green or light green and yellow-mottled foliage which causes a decrease in yield. The appearance of such leaves is illustrated in figure 3. The color pattern of manganese-deficient beet leaves is very similar to that of many other plants. The tissue between the veins may become quite yellow but a good green color may be maintained for a short distance on either side of the veins. The symptoms show first in early summer, when there is still time to remedy the condition by a side-dressing of manganese fertilizer.

* Michigan Experiment Station Special Bulletin No. 205. 1930.

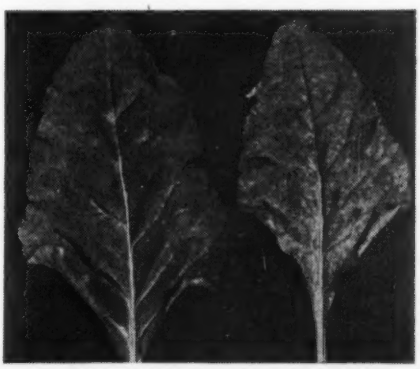


Fig. 3. Sugar beet leaves. The left leaf is normal. The right leaf is from a plant deficient in manganese. Such leaves are mottled yellow and green.

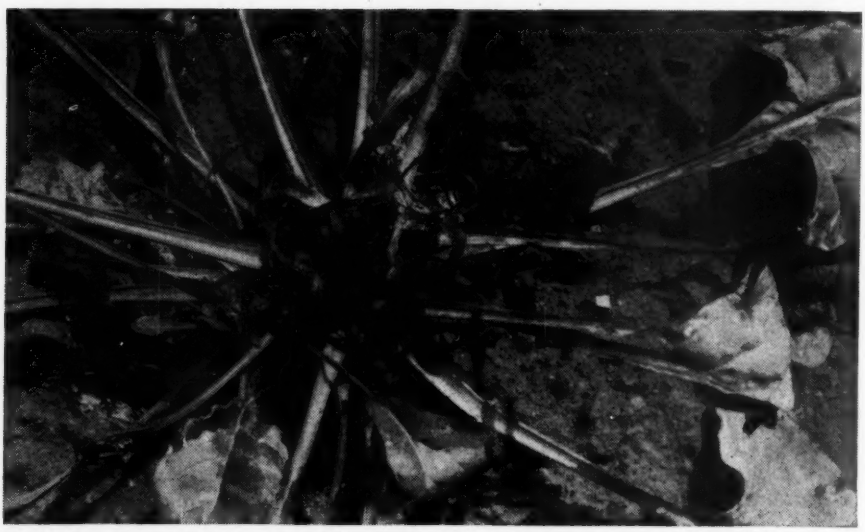


Fig. 4. Sugar beet in the last stages of heart rot. The entire crown is rotten. Growth has almost ceased. Such beets sometimes start a second growth very late in the fall. The new leaves come out around the edge of the dead heart.

The data presented in table 4 show the results obtained from such side-dressings made in 1943 and 1945. On the Ackerman farm, near Reese, manganese sulfate was applied as a side-dressing and as a spray. The side-dressing was made at the rate of 100 pounds per acre, while the spray was at the rate of 5 pounds per acre. The results from the small amount applied as a spray were almost as good as from the larger quantity applied as a side-dressing where the increase in yield was exactly seven tons per acre. The improvement in the color of the beets on this field was very marked and was noticeable within 10 days of the date of application. Color changes were also very marked in the beets on the Schroeder farm near Midland. The treatments on the two farms were made on the same day. Strangely, however, yield increases on the Schroeder farm were very slight, only one-half ton per acre, an amount within experimental error.

Cold, wet seasons seem to induce manganese starvation. This is true because manganese availability is linked

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TABLE 4.—THE EFFECT OF MANGANESE SULFATE ON SUGAR BEET YIELDS

Treatment	Tons beets per acre			
	1943 Ackerman Berrien sand alkaline	1943 Schroeder Berrien sand alkaline	1945 Kuschinsky burned-over muck alkaline	1945 DuRussell burned-over muck alkaline
None	10.8	9.4	9.2	13.4
$MnSO_4$ side-dressed*	17.8	9.9	.....	.....
$MnSO_4$ spray**	16.7	.....	10.2	15.3

* 100 pounds per acre.
** 5 pounds per acre.

The Effects of Fertilizers on Blackland Soils of Texas

By M. F. Wichman*

Soil Conservation Service, Temple, Texas

FOR many years a stock statement of farmers in the Blacklands of Texas has been: "Fertilizers do not pay." Nevertheless, Blackland soils do need plant nutrients. The trouble has been that the methods for applying those nutrients were not known. Only recently have a few of the facts on how to add fertilizers successfully to those soils begun to seep out.

Soils of the Blackland, having high exchange capacities** and a high per cent of replaceable calcium—many possessing more than 20,000 parts per million, have not shown economical response when inorganic complete*** fertilizers were applied to such crops as cotton or corn. This may be because of sources of organic or inorganic fertilizer materials, low organic matter, fineness of the fertilizing material, free calcium, soil reaction, or any one of a number of other factors.

With phosphate and the response it brings when used on winter legumes in the Blacklands in mind, a study of soil conditions was made by the Soil Conservation Service Operations Soils Laboratory at Temple, Texas. Cooperators of the Comal-Hays-Guadalupe Soil Conservation District in the vicinity of Seguin, Texas, provided soil samples from fields which had received different applications of phosphate on winter legumes.

Roland Dueln, one of the district cooperators, realized that the productivity of his soil was being depleted; he wanted to do something about building his soil's fertility. With technical advice from the Soil Conservation Service technicians working in the district he fertilized 12 acres of a deep, fine-textured, slowly-permeable, gravelly Blackland soil with 300 pounds of 20 per cent superphosphate and planted a crop of hubam sweet clover. On five acres of the same soil and in the same field no phosphate was applied. The treatment otherwise was the same.

On the 12 acres where phosphate was applied Dueln cut 389 bales of hubam clover hay while on the five acres which did not receive phosphate he could get only 35 bales of the hay.

Soil analysis made after the hay was cut and the land broken resulted in a recommendation that Dueln apply 40 pounds of phosphorus and 21 pounds of potassium per acre on the acre which had grown the phosphated sweet clover if he wished to grow more winter legumes. Larger amounts of the fertilizers were suggested for the area which had not been phosphated. There the soil analysis showed a need for 60 pounds of phosphorus and 28 pounds of potassium per acre before planting another winter legume.

Roy Glenewinkel, a cooperator with the Comal-Hays-Guadalupe Soil Conservation District, saw that his soil was severely eroded, low in organic matter, and that there was either a plant-food nutrient deficiency or a low plant-food nutrient level.

* The author wishes to extend due credit to James W. Lodwick, work unit conservationist for the Soil Conservation Service at Seguin. Mr. Lodwick gathered the field notes used in this study.

** The ability of a soil through its small organic or inorganic particles—called colloids—to hold fertilizing materials so that the plants may take them up. Often expressed in m. e. (milli-equivalents).

*** Containing potash, nitrogen, and phosphate.

Glenewinkel decided to see what phosphate would do on his deep, fine-textured, slowly-permeable Blackland soil. With suggestions from the Soil Conservation Service technicians he laid out a group of plots. On one of them he spread 250 pounds of superphosphate and planted Austrian winter peas. The peas on the area were well matted and grew to be 30 inches tall. Another plot was given the same treatment, except that no phosphate was applied under the peas. Here the peas grew thinner and reached only 15 inches in height. A third plot of soil received no legumes and no phosphate. It had been cropped to corn, cotton, and feed crops. This plot was analyzed for comparison. The laboratory recommended that Glenewinkel use the following fertilizers if he wished to grow winter legume crops on the three plots. For Plot 1, the suggestion was 60 pounds of phosphorus and 28 of potassium to the acre; plots 2 and 3 showed a need for 70 pounds of the phosphorus and 21 of the potassium per acre.

Allen Erskine of Seguin, Texas, has had experience with phosphate under hubam sweet clover. His soil, like Glenewinkel's, is a deep, fine-textured, slowly-permeable Blackland soil. Very likely his soil is an old high terrace of the Guadalupe River. On one terrace interval of his farm, he applied 200 pounds of 20 per cent superphosphate to the acre and planted hubam clover. From this area, 23,450 pounds, green weight, of hubam clover were obtained. An area alike in size and soil type on an adjacent terrace interval was treated in the same way, except that no phosphate was applied under the hubam clover. From this area 9,500 pounds, green weight, of hubam clover were obtained. The soil technician recommended use of 42 pounds of phosphorus and 21 of potassium per acre on the area which produced the heavy weight of clover if Erskine desired to grow other winter legume crops there. The area which grew the lighter weight in clover, that which had not been phosphated, needed 56 pounds of phosphorus and 28 of potassium per acre before it would grow winter legumes at its best, according to the soils analysis made there.

All of the soil analyses give a lead that needs more extensive study before more accurate recommendations can be made for soil-improving and soil-building crops on the Blacklands. Based on analyses made to date, there are indications that the plant-food nutrient level for Blackland soils should probably be: 80 to 110 parts per million available phosphorus; 120 to 140 parts per million available potassium; and around 20,000 parts per million replaceable calcium. In Blackland soils there seems to be a closer relationship between available phosphorus and available potassium than in soils of other basic land resource areas. In these soils the exchange capacities in m. e. are variable, as are the amounts of available phosphorus. The replaceable calcium and available potassium are less variable.

This map shows the Blacklands of Texas. Seguin, Texas, is located toward the southern end of the Blacklands.

On the Erskine farm where 23,500 pounds, green weight, of hubam clover were plowed under, the organic matter in the soil was 2.27 per cent. On the other area of that farm the organic matter was only 1.27 per cent. Here the amount of organic matter and prob-

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Rice Nutrition in Relation to Stem Rot of Rice[1]

By E. M. Cralley

Arkansas Agricultural Experiment Station, Fayetteville, Arkansas

THE relation of host nutrition to the prevention or amelioration of plant diseases has received considerable attention in recent years. Work on certain Fusarium wilts, for example cotton wilt (*Fusarium oxysporium f. vasinfectum*), shows in general that host susceptibility is increased by high nutrient levels of nitrogen and phosphorus and reduced by high levels of potassium. On the other hand, sclerotium rot of sugar beets (*corticium rolfsii*) and tobacco wilt (*Bacterium solanacearum*) are reduced in severity, under certain conditions, by the application of nitrogenous fertilizers. Since it is obvious that the parasite as well as the host may react variously to certain nutritional environments, a study must be made of each host-parasite complex in order to utilize, if feasible, cultural practices to reduce disease losses.

Preliminary work on the relation of host nutrition to the development of stem rot of rice has been published previously (1). The results showed, in general, that heavy applications of nitrogenous fertilizers increased stem-rot severity, whereas medium to heavy applications of potash decreased it. Since this work was done, additional opportunities have been afforded for observing the effects of potassium, alone and in combination with other elements, on the development of stem rot on different rice varieties.

In the greenhouse, observations were made on the effects of two levels of potassium on the severity of stem rot on Early Prolific, Fortuna, and Asahi rice varieties. The plants were grown

[1] Research paper No. 823 Journal Series, University of Arkansas. Published with the permission of the Director of the Arkansas Agricultural Experiment Station.

(1) Cralley, E. M. *Effects of Fertilizer on Stem Rot of Rice.* Ark. Agr. Expt. Sta. Bul. 383, 1939.

TABLE 1.—EFFECTS OF TWO LEVELS OF POTASSIUM ON DISEASE INDICES AND YIELDS OF RICE VARIETIES GROWN IN GREENHOUSE.

	Early Prolific	Fortuna	Asahi
	Disease Indices [3]		
Low potassium [1]	39.9	55.6	74.0
High potassium [2]	30.9	4.2	35.7
	Yields in Grams [3]		
Low potassium [1]	12.2	20.5	21.9
High potassium [2]	15.2	24.9	35.1

[1] 2 ppm; [2] 10 ppm; [3] Average of four replicates.

TABLE 2.—EFFECTS OF FERTILIZER TREATMENTS ON STEM-ROT SEVERITY AND YIELDS OF RICE VARIETIES, STUTTGART, ARKANSAS—1940.

Variety	Fertilizer treatments per acre [1]						
	600 lbs. 6-0-0	300 lbs. 0-0-12	600 lbs. 0-0-12	300 lbs. 6-6-12	600 lbs. 6-6-12	600 lbs. 6-0-12	No Treatment
	Disease Indices [2]						
Fortuna	66.99	44.16	42.66	49.50	56.66	59.74	50.16
Supreme Blue Rose	32.74	20.58	19.16	17.00	21.66	23.41	26.41
Kamrose	49.08	29.50	29.33	35.16	30.91	34.41	35.58
Mean	49.61	31.41	30.39	33.89	36.41	39.19	37.39
	Yields in Bushels per Acre [2]						
Fortuna	38.33	37.08	38.25	40.83	43.92	42.50	37.00
Supreme Blue Rose	29.75	23.91	24.50	27.16	31.74	30.08	25.25
Kamrose	34.99	26.91	29.33	30.91	33.58	34.16	30.83
Mean	34.36	29.30	30.69	32.97	36.41	35.58	31.03

[1] N=Ammonium sulphate; P=superphosphate; K=potassium sulphate.
[2] Means of four replications.

in sand culture using the following concentration of elements in parts per million: K, 2 and 10; N, 10; P, 8; Ca, 7.5; Mg. 2.5; and traces of Fe, B, Cu, Mn, and Zn. The results, presented in table 1, show that the disease indices (a high disease index signifies severe disease infection) were higher, for each variety tested, at the low potassium level than at the high potassium level. Also the yields were higher at the high potassium level.

During 1940 and 1946, observations were made in the field on the effect of various fertilizer combinations on stem-rot severity and yield of rice varieties. The fertilizers were applied the first week in July. The experimental plots were drained about five days before the applications were made and were re-flooded in three days. In 1940 (see table 2), 600 pounds of 6-0-0 fertilizer increased the stem-rot severity on the three varieties tested, whereas 300 pounds of 0-0-12, 600 pounds of 0-0-12, and 300 pounds of 6-6-12 fertilizer per acre decreased it. The stem-rot severity was about the same on the non-treated plots as on the plots receiving 600 pounds of 6-6-12 and 600 pounds of 6-0-12 fertilizer per acre. The yields on this test were very low and showed significant increases in yield only when applications of 600 pounds of 6-0-0, 6-6-12, and 6-0-12 fertilizers per acre were made.

In 1946 (see table 3), Zenith, Prelude, Arkansas Fortuna, and Nira varieties were fertilized with 400 pounds of 10-0-0 and 10-4-10 fertilizer per acre. The Zenith variety was moderately infected with stem rot at the time of harvest when the disease notes were taken; however, no plants were lodged. With the other varieties, lodging was significantly increased when the nitrogenous fertilizer was applied and slightly decreased when the complete fertilizer was applied. Both fertilizers significantly increased yields when compared with the non-treated plots. The benefits of the complete fertilizer in compari-

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From new fertilizer experiment, 1945-1946. The 8-0-16 side-dressing used contained 2½ lbs. borax per acre. Two-year average returns per acre: 1,553 lbs. at $812.41.

Fertilizer Practices for Profitable Tobacco

By E. M. Matthews

Virginia Bright Tobacco Station, Chatham, Virginia

THE value of research in improving Virginia's tobacco, a 73 million dollar cash crop in 1946, is beyond dispute. Many controllable factors contribute toward producing a highly successful and profitable tobacco crop, such as soil selection and management, varieties, fertilizer practices, spacing, topping, disease and insect control, harvesting, and marketing. However, on fields with typical tobacco soils no one factor plays quite so important a part as the fertilizer practice. Normal treatments in plant-food applications produce, at present, crop values varying widely even on the same fields and during the same season, often as much as $150 or more per acre.

Variations in fertilizer practices which produce such widely varying acre returns are of vital importance to thousands of Virginia tobacco farmers. If used by 20,000 or that half of Virginia tobacco growers who are below even the general average in acre values realized for their crops, such practice changes last year would have added an extra 11 million dollars to the income of half of our tobacco farmers.

The purpose of this article is to de-

scribe briefly these important practices, and the research projects from which they are derived.

In a rather comprehensive fertilizer experiment conducted on the Chatham Station for eight years, unfertilized flue-cured tobacco grown on the best soils produced less than $100 per acre (at present tobacco prices), while well-fertilized tobacco in 1945 and 1946 on the same field produced average values for eight replicate plots varying for different treatments from $679 to $789 per acre (see table). Duplicate plot treatments produced 2-year average values varying from $640 per acre for tobacco which received 900 pounds of 3-9-6 fertilizer per acre, not mixed in the soil before listing, not side-dressed, and spaced 24 inches in rows 4 feet apart, to $819 per acre for tobacco which received 1,200 pounds of 3-9-6 fertilizer thoroughly mixed in the furrow row with a 10-inch-shoe, single shovel plow before listing, side-dressed 20 days after planting with 100 pounds per acre of 8-0-16 side-dresser containing 2½ pounds of borax, and spaced 20 inches apart in 4-foot rows.

The project from which the above results were obtained was designed to determine: (1) The optimum rates of the best recommended fertilizer; (2) the effect on yield and quality of tobacco from several different side-dressing analyses; (3) the effect on yield and quality of spacing closer than recommended in the past or practiced by most farmers; and (4) the effect on stand, yield, and acre value of mixing heavy applications of fertilizer thoroughly in the furrow row before listing.

The purpose of this test, in general, was to gain information which would enable this Station to give sound advice to flue-cured tobacco farmers of Virginia as to the best practical fertilizer practices for obtaining maximum acre yields of good quality cigarette tobacco. Past projects on this Station, although they had answered certain phases of this question, had not been so designed as to fully satisfy the present demand for knowledge on how to produce larger yields of quality tobacco on fewer acres.

Procedure

Fifty-six $\frac{1}{40}$-acre plots were required. Granville sandy loam soil type was used. A standard 3-9-6 fertilizer was applied at rates varying from 900 to 1,500 pounds per acre in the furrow before listing the land previous to transplanting. Side-dressings varied as shown in the following table. Seven different fertilizer treatments were used, first with the plants spaced 24 inches in rows 4 feet apart and then repeated with 20-inch spacing. All treatments were repeated four times with randomized arrangement in each replicate. In two replicates of each spacing the fertilizer was thoroughly mixed with a single shovel plow in all plots before listing, while with the other replicates all plots were listed without mixing the fertilizer.

Records of replants necessary, acre yields, and values were made in the usual manner practiced on this Station. Summaries of these are given in the following table.

Discussion of Results

Although this experiment has been conducted in its present form for only two seasons, the results which concur so closely with those obtained from several similar experiments conducted on the Chatham Station during the past 12 years are so consistent throughout the several replications that conclusions seem fairly safe.

The two-year summary of results for the 56 plots as given in the table shows eight replicate average acre values of $679.25 when 900 pounds of 3-9-6 fertilizer are used and $788.53 (or $109 increased value) when 1,200 pounds of the same fertilizer are used before transplanting and 100 pounds of 8-0-16, with 2½ pounds of borax added, are used as a side-dresser just ahead of the cultivator 20 days after transplanting.

A comparison of results for the four replicate plots each, plants spaced 24

TABLE 1.—RATES OF FERTILIZER, SIDE-DRESSING, METHOD & SPACING TEST, CHATHAM

1945–1946—Average
(Fertilizer & Yields per Acre)

Treatment No.	Fertilizer: At planting	Fertilizer: Side-dressed 20 days	Four-plot average Spaced 24" Lbs.	Four-plot average Spaced 24" Value	Four-plot average Spaced 20" Lbs.	Four-plot average Spaced 20" Value	Eight replicate plot average Lbs.	Eight replicate plot average Value
1	900 lbs. 3–9–6	None	1,245	$663.53	1,317	$694.98	1,281	$679.25
2	1,200 lbs. 3–9–6	None	1,453	767.24	1,480	784.12	1,467	775.68
3	1,500 lbs. 3–9–6	None	1,485	772.28	1,525	782.84	1,505	777.57
4	900 lbs. 3–9–6	100 lbs. 8–0–16+B*	1,421	751.32	1,510	806.21	1,465	778.77
5	900 lbs. 3–9–6	100# 10–0–10+B	1,433	754.41	1,467	781.25	1,450	767.70
6	900# 3–9–6	100# 5–5–20 (com.**)	1,383	725.60	1,477	780.06	1,430	752.84
7	1,200# 3–9–6	100# 8–0–16+B	1,416	764.65	1,553	812.41	1,509	788.53
7 Treatment averages			1,405	742.68	1,495	777.41		
Average value ¢ per pound				52.8		52.5		

* 2½ lbs. borax per acre when used.
** Commercial, no borax mentioned on tag or bag.

Treatment No.	Fertilizer: At planting	Fertilizer: Side-dressed 20 days	Four-plot average fert. mixed before listing Lbs.	Four-plot average fert. mixed before listing Value	Four-plot average *not* mixed before listing Lbs.	Four-plot average *not* mixed before listing Value	Per acre loss	Replants per acre: Mixed	Replants per acre: Not mixed	% Stand at harvest: Mixed	% Stand at harvest: Not mixed
1	900# 3–9–6	None	1,341	$706.53	1,221	$652.10	$54 –	325	596	98	98
2	1,200# 3–9–6	None	1,486	784.63	1,448	766.74	18 –	503	870	97	97
3	1,500# 3–9–6	None	1,559	801.14	1,452	754.01	47 –	740	860	96	95
4	900# 3–9–6	100# 8–0–16+B	1,493	784.33	1,437	772.87	12 –	350	630	98	98
5	900# 3–9–6	100# 10–0–10+B	1,470	770.55	1,429	763.85	7 –	320	690	98	98
6	900# 3–9–6	100# 5–5–20 (com.)	1,483	764.91	1,376	740.77	24 –	280	490	98	99
7	1,200# 3–9–6	100# 8–0–16+B	1,544	797.24	1,476	779.82	18 –	470	840	99	98
7 Treatment averages			1,482	$772.76	1,406	$747.17					

inches and 20 inches apart in the rows, would indicate that for all normal fertilizer applications the 20-inch spacing in four-foot rows is about right notwithstanding the fact that the 20-inch spacing produces slightly more dead, perished type of cured leaf from the lower primings than the wider spacing does (particularly when heavily fertilized). The $35 per acre increased average value from the 20-inch spacing would seem significant.

By studying the four replicate plot average values for each of the fertilizer treatments when mixed thoroughly in the furrow before listing as compared with the same fertilizer when not mixed before listing, it can be seen how much a farmer might lose by not mixing his fertilizer in the row furrow before listing, (in the absence of a fertilizer distributor which would apply this fertilizer in bands to the sides of the plant roots). When using heavy applications of fertilizer such as 1,500 pounds per acre, this loss ran as high as $47 per acre for two years, and the average of returns for all 28 plots when the fertilizer was mixed was $26 per

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Harvey Neely, S. C. Farmer, Makes More Than 3 Bales Per A.

By H. G. Boylston

Clemson Agricultural College, Clemson, South Carolina

SIXTEEN and one-half bales of cotton produced on five acres is the yield made by J. Harvey Neely, Smith Turnout, Chester County, South Carolina. More than three bales per acre is a record certainly for this part of the cotton belt. The average of first state prize winners for the 19 years the contest has been conducted has been 12½ bales on five acres.

A major contribution to better yields of high quality cotton has been made by the South Carolina Five-Acre Cotton Contest. The most profitable practices have been proved by this contest. Some of these are narrow rows, good stands, liberal fertilization of proper balance, good seed of high-yielding varieties, use of lime, poison, defoliation, etc. Mr. Neely has probably had more experience with dairying in a great Guernsey County than with cotton production except for the past few years, but he carried out the best practices, as he thought, for his conditions and with good seasons a record was made.

Mr. Neely, standing in the field which he entered in the contest.

How did he do it? On good quality Iridel soil, commonly called black jack, he planted his contest field where cotton has followed cotton for maybe the past 20 years. But in 1946 he applied about five tons of stable manure per acre and although his type of soil does not tend to be very acid, he has applied about 400 pounds of ground limestone per acre for the past five years including 1946. No doubt the annual application of manure and some lime has contributed much to the fine condition of his soil.

The soil preparation consisted only of ripping up the old cotton stalks, broadcasting 1,000 pounds of 4-8-8 fertilizer per acre, and harrowing. Then the rows were bedded 33 inches apart the last of March. The planting of the cotton was done on April 11-13 after treating the Coker 100 Strain 8 cotton-seed with ceresan.

A good stand of cotton was secured and left about 12 inches apart.

Side applications of potash and nitrogen were made on June 3 and 17. The first was a mixture of 100 pounds of 50 per cent muriate of potash and 100 pounds of nitrate of soda; the second was 100 pounds of ammonium nitrate and 100 pounds of muriate of potash.

Some of the cotton which yielded more than three bales per acre and made a record.

Two applications of 1-1-1 sweetened poison were made on June 2 and July 11 to assist in the control of the boll weevil.

On October 1 the cotton was defoliated with an aeroplane using aero defoliant. With the heavy growth and narrow rows of heavily fruited cotton, the defoliation was found to have been of much benefit, saving many of the bolls which might have rotted and allowing all matured cotton to open quickly.

Some of the secrets of Mr. Neely's high production are: Good soil of high fertility; liberal applications of stable manure; narrow rows—33 inches with a good stand in the drill; use of liberal amounts of commercial fertilizers and side-dressing of nitrates and potash; use of an outstanding variety, Coker 100; careful attention with frequent shallow cultivation; and use of lime, defoliation, and insect control. These good practices followed by Mr. Neely have been found to be best by contestants in the years past. As one example, take the width of row. When the contest was first started in 1926 there were no contestants who had rows 34 inches or closer, while in 1946 about 20 per cent were 34 inches or less. The average yields for 19 years show the following:

22-34	width	658	lbs. lint per acre
35-37	"	624	"
38-40	"	603	"
41-43	"	578	"
44-46	"	540	"
47-49	"	529	"

Mr. Neely's rows were 33 inches wide, which is the width showing the largest yield for entire period of the contest.

A summary of the last five years on varieties shows that there were five which had been planted each year in sufficient numbers to make a comparison. The following table gives the average yield:

Coker 100 W.R.	711
Coker 100	702
Coker's 4 & 1	637
Marett's White Gold	635
Delta Pine Land	634

Mr. Neely's contest field was planted in Coker 100.

On his contest field which won first state prize of $750, Mr. Neely had a gross value of $3,600.75 for his cotton and seed with a cost of $677.16, giving him a net return of $2,923.59.

Fig. 1. Alfalfa hay from various fertilizer treatments on a low-fertility Crosby silt loam near Lafayette, Indiana, first cutting 1942. Treatments from left to right: Lime alone; lime + phosphorus + potash; lime + phosphorus; and lime + potash.

Don't Feed Alfalfa at the Second Table

By H. E. Jones

Department of Agronomy, Kansas State College, Manhattan, Kansas

ONE of the oldest alfalfa fields in the Midwest is located on the Purdue Soils and Crops Experimental Farm, Lafayette, Indiana, where alfalfa has been grown continuously since 1917 in fertility experiments on Crosby silt loam soil. The unusually high yields from these plots over a 25-year period are quite remarkable. The fertilizer treatments have been only moderate and the differences in yields between the fertilized and unfertilized plots have been relatively small.

The question as to the quantity of phosphate and potash removed from these plots by the alfalfa throughout this long period has sometimes been raised. A study of the potash situation in the soils of the plots was made in 1942. The results of the analyses are shown in table 1. It is obvious from the data shown that this experiment was conducted on a soil unusually high in potash, both available and total. There is no striking difference between the values as related to the treatments. However, there is some indication that the supply of available potash on the plot treated with lime, potash, and superphosphate is reaching the mini-

[1] Formerly Research Assistant, Departments of Agronomy and Agricultural Chemistry, Purdue University; now Assistant Professor of Soils, Department of Agronomy, Kansas State College.

TABLE 1—AVAILABLE AND TOTAL POTASH, EXPRESSED AS POUNDS K_2O PER ACRE EIGHT INCHES, IN VARIOUS PROFILE DEPTHS FROM THREE DIFFERENT PLOTS ON THE ALFALFA FERTILITY EXPERIMENT ON THE SOILS AND CROPS FARM, LAFAYETTE, WHERE ALFALFA HAS BEEN GROWN CONTINUOUSLY FOR 25 YEARS.

Depth in inches	Pounds per acre eight inches available[1] and total potash (as K_2O)					
	Lime alone		Lime, potash, check		Lime, potash, superphos.	
	Available	Total	Available	Total	Available	Total
0–8	219	45,900	331	44,300	188	48,300
8–16	385	47,200	287	44,300	242	47,400
16–24	373	43,700	259	49,300	342	55,200
24–32	294	47,400	293	49,100	262	47,700
32–40	265	51,700	299	52,300	240	46,900
Total	1,436	235,900	1,469	239,300	1,274	245,500
Ratio total available	164		162		190	

[1] Extracted with neutral normal ammonium acetate solution.

mum level for continued high production.

In table 2 it is seen that the differences in yields of alfalfa from the various fertility treatments were not great in any case. The yield of alfalfa from the untreated plot was so high that it is not reasonable to expect any great deficiency in potash or phosphate; consequently, the response to the addition of these two plant-food nutrients could be only very slight. In comparing the yield of the alfalfa on the untreated plot with the average for the State of Indiana, it is clear that the soils in the experiment were unusually fertile.

Table 3 shows that the alfalfa in this experiment has been pumping out of the ground a tremendous quantity of phosphate and, particularly, potash. The amount of fertilizer removed per acre over the 24-year period amounts to approximately 14,600 pounds of an 0-5-15 fertilizer. This would be about 600 pounds per acre per year. Allowing for phosphate and potash fixation,

TABLE 2.—YIELDS OF HAY FROM VARIOUS FERTILIZER TREATMENTS ON CONTINUOUS ALFALFA ON SOILS AND CROPS FARM, LAFAYETTE, IN COMPARISON WITH THE AVERAGE FOR THE STATE AS A WHOLE.[1]

Location and/or plot and treatment[2]	Yield (tons per acre)	
Soils and Crops Farm, Lafayette	1929–40	1917–28
Untreated plot	3.26	3.34
Lime alone	3.42	3.47
Lime and phosphate (Ppt. bone)	3.58	3.56
Lime and potash	3.88	.....
Lime, potash, and superphosphate	4.18	.....
Average for Indiana (1930–39)	1.69	.....

[1] Yields for the continuous alfalfa on Soils and Crops Farm taken from Purdue Circular 242 (revised May 1941). The average for Indiana taken from Indiana Crops and Livestock Estimates No. 206, 1942.
[2] Plots having phosphate and potash applied received 80 pounds P_2O_5 and K_2O, respectively, every two years.

about 1,125 pounds of a fertilizer such as 0-8-12 would be needed each year to replace the loss.

The available potash and phosphate supplies in most upland soils of the State are far below the quantity needed for such high yields as are produced on these plots. The experiment thus serves the purpose of demonstrating the remarkable yields that can be made when adequate minerals, proper drainage, and effective inoculation are provided. The experiment also discloses the huge quantities of available phosphate and potash that are necessary to produce such yields.

Table 4 reveals the available potash content of some of the principal cultivated upland forest soils of Indiana to be characteristically closer to 150-175 pounds per acre eight inches than the 219 pounds shown on the untreated plot of the experiment. It is interesting to note that as much available potash is present in the soils of these plots after 25 years of continuous alfalfa as is found in some of the virgin upland forest soils of Indiana. When these facts are considered in relation to the soils of the State that are low in fertility, it becomes obvious that big yields of alfalfa cannot be made or maintained unless the plant-food nutrients are added in such amounts and in effective manners as to make up the differences necessary to produce the high yields.

When alfalfa, which feeds heavily out of the subsoil through its deep root system, is first grown on a soil it may find available potash that has not been withdrawn by previous crops. A small quantity of this plant nutrient added in the upper soil in fertilizers will help the crop to get started and the roots will penetrate into the deeper soil. For some years the production may be quite satisfactory, depending upon the native fertility. Many farmers complain that where alfalfa is seeded on old alfalfa land after a prolonged period of production the performance or response with fertilizers as used in previous crops has not been like it was with the first crop. It seems reasonable that the soil, particularly the subsoil, has been somewhat exhausted by the previous crops.

Alfalfa, along with other legumes such as sweet clover, lespedeza, and soybeans, has been termed a soil-building crop. Statements in bulletins and in farm papers as follows can be found:

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TABLE 3.—PHOSPHATE AND POTASH REMOVAL BY ALFALFA HAY, EXPRESSED AS POUNDS PER ACRE P_2O_5 AND K_2O, FROM THE VARIOUS PLOTS IN THE CONTINUOUS ALFALFA FERTILITY EXPERIMENT ON THE SOILS AND CROPS FARM, LAFAYETTE, DURING THE 24 CROP YEARS 1917-40.

Treatment [1]	Phosphate and potash removed from plots by the hay [2]					
	Lbs/acre P_2O_5 removed			Lbs/acre K_2O removed		
	12 years (1917–28)	12 years (1929–40)	24 years (1917–40)	12 years (1917–28)	12 years (1929–40)	24 years (1917–40)
Untreated	353	344	697	1,064	1,041	2,105
Lime alone	369	361	730	1,109	1,091	2,200
Lime, phosphate as ppt. bone	376	379	755	1,136	1,145	2,281
Lime, potash	.....	408	.....	.....	1,238	.....
Lime, potash, superphosphate	.....	442	.....	.....	1,333	.....

[1] Potash was added to the treatments in the fall of 1928 so there are no yield data showing the effect of potash in the treatments prior to 1929.

[2] Yields were taken from Purdue Circular 242 (revised May, 1941). They are shown in table 2. Per cent composition of P_2O_5 and K_2O in alfalfa hay taken from Purdue Bulletin 468.

Fig. 1. A community equipment repair shed was the idea of the Leesburg community in Washington County. The shop and tools were available at all times for use by anyone in the community, and machinery was kept running during the period when it was scarce and badly needed for all-out production.

Community Improvement Contests

By S. Fletcher Sweet

Agricultural Extension Service, University of Tennessee, Knoxville, Tennessee

COMMUNITY improvement through concerted community action is on the march in Tennessee, with more than 25,000 farm families in organized improvement contests last year. The State is now covered by such contests, and both the sponsors and the contestants agree that the sky is scarcely the limit.

Improvement contests in Tennessee are relatively new, although the community organization is now a grown-up baby of the Agricultural Extension Service, University of Tennessee. With a majority of communities in every county of the State already organized, the strong green light was thrown upon community improvement when civic clubs in various trade areas started giving prizes for the best improvement jobs.

This started in 1944, through cooperation of 10 civic clubs and organizations of Knoxville. These groups, realizing what a dressed-up East Tennessee would mean with respect to the millions of visitors coming to the Smoky Mountains National Park, now leading the country in the number of visitors, offered the first community prizes. The East Tennessee Community Improvement Contest was on its way, covering the hills and valleys from the Smokies to the Cumberland Mountains.

The following year the Farmers' Club of the Nashville Chamber of Commerce started a similar contest, covering 38 counties of the Central Basin, with its rolling lands, dairying, tobacco growing, and generally diversified farming. And in 1946 the civic organizations of

Chattanooga launched the Lower East Tennessee Improvement Contest, covering 11 Tennessee counties and two in Georgia. Since the Memphis Commercial Appeal had sponsored the Plant-to-Prosper contest in the cotton lands of West Tennessee for some years, the State was now covered with an organized upsurge for improved living—better homes on better farms.

Sectional and local sponsors contribute a total of about $10,000 in prizes for county and area winners. It works this way: An elimination race is sponsored by some local organization in each county. The winner from each county is then entered in the area contest to compete with winners from other counties for the various prizes and the sweepstakes.

Here is how community leaders feel about such contests, as expressed by Ralph Shanlever, chairman of the Dutch Valley community organization in Anderson County: "Cash prize or no cash prize, we should enter the contest," young Shanlever, a real dirt farmer, said. "We have found that our community must work together to get anything it wants. The improvements we make in our homes and on our farms will be lasting gains, whether we win a prize or not. I'll put the idea before the group for a vote at our next meeting."

The Dutch Valley group of about 50 families voted unanimously to enter the contest; and although 1946 was their first year in the race, they placed high among the 21 competing counties of their area.

Since scoring in the contests is based upon improvement in farms and homes, the Tennessee Agricultural Extension Service cooperates closely with communities in improvement programs which the organizations themselves draw up. Many Extension specialists help with judging throughout the State.

Here is the contest pattern adopted by the Knoxville civic organizations, in launching the East Tennessee Community Improvement Contest in 1944: Scoring is based upon 1,000 points, divided as follows: 200 points on home food supply; 200 on maintenance

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Fig. 2. Winter pastures were one of the improvement features stressed in plans of the Cedar Grove community in Van Buren County. Cattle seen in the fields above will spend most of the winter outside the barn and away from hay ricks.

The Search for Nutrient Deficiencies in Farm Crops

By R. E. Stephenson

Department of Soils, Oregon State College, Corvallis, Oregon

PLANTS require from the soil, air (oxygen), water, and nutrients. All these must be accessible to the root system. In the best soils, the root systems of common agricultural crops will occupy and function in 6 to 10 feet or more of soil depth. And unless the root can develop and function normally, yields will be correspondingly limited.

The capacity of the soil to furnish the root system with a renewed supply of oxygen depends upon an important physical property, the soil structure. Air circulates through the larger open channels in the soil, such as wormholes, openings left by decaying roots, and all the larger spaces left when gravity removes excess water. The important soil organisms, as well as the crop, require oxygen. The oxygen of the air is used by the root system of the crop for oxidizing carbohydrates to obtain energy for vital process. As a result of the oxidation, carbon dioxide is eliminated from the root into the soil. Good soil aeration provides for the ready passage of the carbon dioxide produced by the roots of plants and the organisms of the soil into the outside atmosphere, and the renewal of the oxygen supply within the soil. Unless these aeration processes can go on unhampered, the plant will suffer.

Water is needed in large quantities by all plants, and this moisture must come from the capillary supply of a well-drained soil. The soil moisture supply is controlled by natural precipitation or by irrigation practice. Where irrigation is not practiced, the crop must depend upon moisture that is stored in the deep soil and accessible to the roots. Without irrigation there is nearly sure to be periods when the plant does not get enough water for maximum growth, thereby reducing the yield. The growth rate of the plant becomes slower as the moisture in the soil is reduced, and is often considerably slower while there is yet an appreciable amount of water in the soil above the wilting point. A renewed supply of moisture before the soil is too dry is important for best plant growth.

Nutrients which plants need for growth are liberated by chemical and biological actions in the soil. While the dry matter of plants is usually more than 90 per cent carbon, hydrogen, and oxygen coming from air and water, the nutrients coming from the soil are none the less important because of their relative lack of abundance in the plant. Anything which the plant uses for growth is important, however minor the amount.

Soil Deficiencies Are Becoming More Common

There are eleven, or possibly more, essential nutrient elements coming from the soil, any one or more of which may be deficient in available form and

thereby reduce the yield of crops. New deficiencies are constantly appearing as more crops are taken from the land.

Increasing appearances of nutrient deficiencies may result from humus depletion following excessive cultivation and intensive cropping practices. Humus contains in various combinations an appreciable portion (sometimes the major portion) of the minor elements essential for plant growth. These include especially zinc, copper, manganese, boron, sulfur, and others. Humus is a no less important source of the major elements (N-P-K). All the nitrogen and sometimes more than half the total phosphorus is in organic combination. The elements contained in the humus are likely to be more available to the plant than the more inert forms of the mineral soil. Loss of humus, therefore, means a real loss of many nutrients that plants must have and reduction in the biological processes necessary for their liberation.

Humus is important for producing solvents which attack the minerals. These solvents include carbonic acid, nitric, sulfuric, and phosphoric acids, which result from the oxidation of organic matter. Humus itself has been shown to be an important purveyor of nutrients, attacking such minerals as anorthite to remove the calcium and transfer it to a form more available to the growing plant.

Erosion and leaching, both of which are likely to increase when land is long under cultivation, provide another cause for nutrient deficiencies. Cultivation increases erosion and bare soils permit greater leaching losses. The top soil which is removed by erosion contains more humus and often more of other nutrients than the deeper soil. Loss of surface soil, therefore, is a heavy drain upon fertility, and particularly upon those nutrients that are most available to the plant.

The increased use of commercial fertilizer, while a desirable practice to produce bigger and more profitable yields, results in a heavier drain upon nutrients not supplied in the fertilizer. Bigger crops take more out of the soil, thereby exaggerating deficiencies. The supply of a nutrient sufficient for 40 bushels of corn may become entirely inadequate for an 80-bushel yield. Therefore, new deficiencies appear as yields are increased by better farming practices. As the pressure of population compels the production of more food to feed an increasing number of hungry mouths by increasing yields and perhaps by farming poorer land, an increase in the prevalence of nutrient deficiencies in the soil may be expected.

Tracking Down Nutrient Deficiencies

The most obvious indication of a deficiency is the appearance of the plant and the yield at harvest time. Foliar diagnosis has come to be a recognized method for spotting nutrient deficiencies. While often providing a valuable clue, this method of diagnosis has its limitations. Two or more symptoms may look so much alike that not even an expert may be sure from appearances. Often there is a mixture of symptoms that cannot be distinguished.

The increasing appearance of virus diseases, manifesting their presence in foliar symptoms, makes diagnosis of nutrient deficiencies increasingly difficult. Neither soil scientist, plant physiologist, nor pathologist can distinguish all the virus symptoms from nutrient deficiency by plant appearances alone.

Chemical methods are helpfully used upon both the soil and the plant for diagnostic purposes. But chemical methods also have limitations. Chemical methods help, but are far from accurate in indicating how much of a given element any particular plant is able to obtain from a soil. Analysis of the plant indicates what the plant contains, but there are no satisfactory standards differentiating deficiency and abundance of many of the elements for

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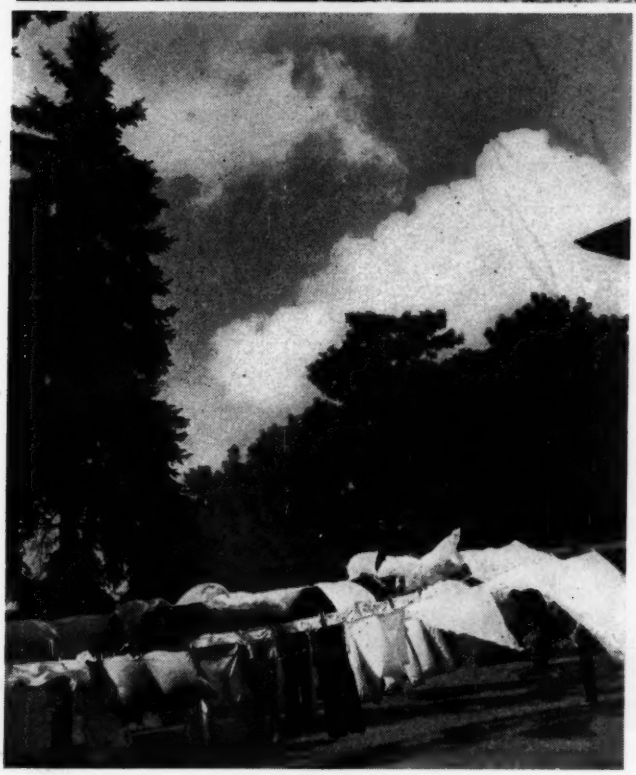
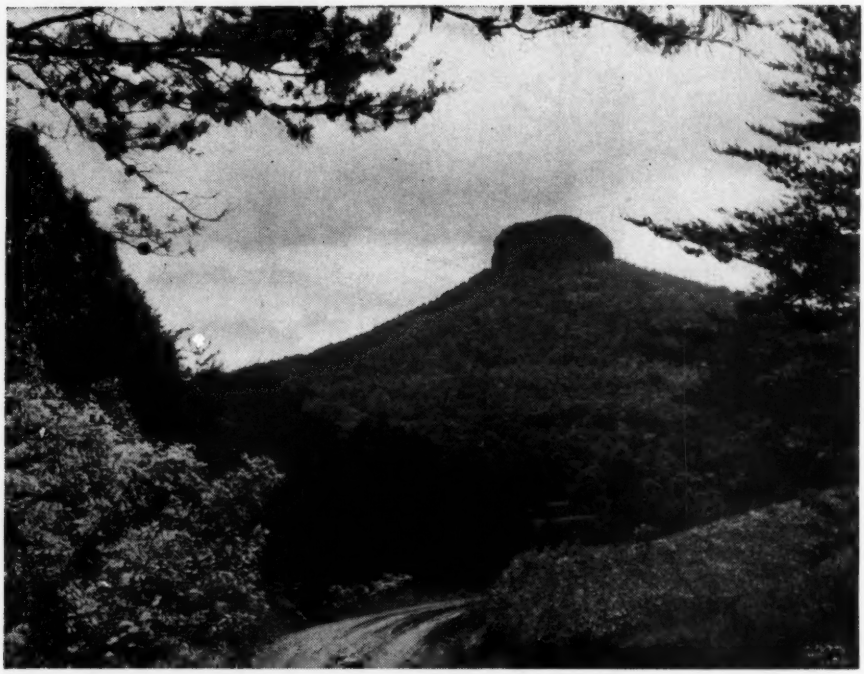
PICTORIAL

THE PROMISE OF AN APRIL HORIZON



Spring Wash-outs

Spring
Planting



Above: **One of the approaches to Pilot Mountain, North Carolina.**

Below: **A ferry boat in operation on the Mississippi River.**

The Editors Talk

Saving Soil on Rented Farms

The problem of how to charge off or apportion lime and fertilizer costs over a period of years, discussed on these pages in our March issue has had considerable attention, judging from correspondence received. For instance, I. W. Arthur, Economist of the Iowa State College Agricultural Extension Service, has sent us a statement which was worked out as a procedure to encourage conservation and the use of soil-building practices on rented farms.

"If a tenant is going to be aggressive in soil conservation work on a rented farm, he must have a guarantee from the landlord that he will receive fair compensation for the unused value in case he has to leave the farm before fully realizing his investment in soil-saving or soil-building practices," the statement says. It goes on to give four steps to follow: (1) List the soil-building practices to be started on the farm during the year; (2) List the contributions to each practice to be made by the owner and by the tenant; (3) Estimate the cost or value of the tenant's contribution to each practice; (4) List the compensation due the tenant for unused value if he leaves the farm before he has had full return on his investment.

On charging off limestone, the Iowa people have this to say:

"The rate of depreciation in value of limestone varies with the type of soil, cropping system, the hardness and coarseness of the limestone used and other factors. Under average conditions the value of limestone may be assumed to last about 10 years. In settling for unused value it may be wise to adopt a more rapid rate of depreciation than is actually believed to exist. This would be done in order to avoid misunderstandings which may arise with the passage of long periods of time. So, for the business purpose of figuring unused or unexhausted value of limestone, it may be wise to settle on the basis of skipping the first full crop year and then using a straight 20 per cent per year depreciation for the next 5 years. This will write off all unused value of the tenant's investment by the end of 6 years.

"The return in increased crop yields from limestone does not usually start until one full crop season after it is applied. Consequently it is desirable to delay one year after the limestone is applied before starting to calculate depreciation." The suggestions for raw rock phosphate are the same as those for lime.

With regard to commercial fertilizers:

"1. Commercial Nitrogen. The value of commercial nitrogen largely disappears with one crop season's use.

"2. Superphosphate, potash, or mixed fertilizers containing mostly phosphorus and potassium.

a. On Corn. (1) When used in hill or row in rates up to 150 lbs. per acre. Unused value: at end of 1st crop season 20%; 2nd season 0. (2) When applied broadcast in amounts from 150 to 300 lbs. per acre. Unused value: End of 1st year 30%; 2nd year 0.

b. When applied at rates up to 300 lbs. per acre to small grain and clover seedings. Unused value: End of 1st year 70%; 2nd year 25%; 3rd year 0.

c. When applied at rates of 300 lbs. or more per acre on alfalfa or pasture seedings. Unused value: End of 1st year 70%; 2nd year 40%; 3rd year 20%; 4th year 0.

"(*Note:* Rates of application for commercial fertilizers mentioned are for purposes of illustration and example only. For recommended rates on your farm see your county extension director.)"

It is of interest to note that in these recommendations in addition to time and method of application, the crop involved is also considered, charging off the fertilizer more rapidly when applied to some crops than when applied to others. This is an indication of the type of approach to the problem which probably should be adapted to local conditions in order to be more equitable under the highly varied cropping and soil conditions existing in this country.

The statement also carries suggestions on matters of contouring intertilled crops, constructing standard terraces, relocation of fences, and farm drainage and carries a "rider" which can be attached to existing farm leases. The attention being accorded these matters should greatly help the conservation movement as well as provide for better understandings between landlords and tenants.

Agriculture Modernizes

Interesting figures are to be found in the March 1947 Agricultural Situation published by the Bureau of Agricultural Economics, U. S. Department of Agriculture. They show, among other things, the streamlining which the American farmers are putting into their productive practices. According to the Bureau, today's farms are bigger, more mechanized, more productive than 25 years ago, or even five.

The 1945 census counted 1.1 billion acres in farmland made up of 5.8 million farms, 600,000 fewer than in 1920. The average farm is about 195 acres, a 50-acre increase since 1920 and a 20-acre jump since 1940. Only 5 per cent of the farms are over 500 acres, but account for half of the farmland. In 1920 they accounted for a third. The 180- to 500-acre farms account for a fourth of the farmland. Today there are about as many as in 1920. The number of small farms, 10 to 180 acres, are now a million fewer than in 1920, largely the result of being absorbed into other farms.

In 1944 the top tenth of the farms produced half of all the farm output, the top third produced 80 per cent. Only 5 per cent had a production worth more than $10,000 each. A fifth had products worth $4,000 or more. The average production of all the farms was between $2,500 and $4,000. Over half of the farms had products worth less than $1,500. From 3,000,000 farms came only a tenth of the record farm output in 1944, when it was a third more than before the war.

Frederick Vieweg

1888-1947

Late President of the American Potash & Chemical Corp., and

Charter Member, Board of Directors, American Potash Institute

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1920.....	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921.....	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922.....	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
1923.....	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924.....	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925.....	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941.....	17.0	26.4	80.7	94.0	75.1	94.5	9.67	47.65	....
1942.....	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943.....	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945.....	22.4	42.6	139.0	200.0	114.0	149.0	15.10	51.80	....
1946									
March.....	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April.....	23.59	42.9	162.0	245.0	116.0	158.0	15.00	48.00	....
May.....	24.09	43.0	157.0	251.0	135.0	170.0	14.80	49.60	....
June.....	25.98	59.0	147.0	251.0	142.0	174.0	14.70	51.50	....
July.....	30.83	56.7	148.0	275.0	196.0	187.0	15.00	60.00	....
August.....	33.55	48.6	143.0	280.0	180.0	178.0	15.10	59.10	....
September...	35.30	48.8	128.0	224.0	173.0	179.0	15.40	57.80	....
October.....	37.69	53.0	122.0	209.0	171.0	188.0	16.10	66.00	....
November....	29.23	43.8	123.0	200.0	127.0	189.0	17.20	89.90	....
December....	29.98	43.5	126.0	210.0	122.0	192.0	17.70	91.50	....
1947									
January.....	29.74	39.0	129.0	220.0	121.0	191.0	17.50	90.40	....
February.....	30.56	31.9	131.0	228.0	123.0	199.0	17.50	82.20	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1920.....	128	173	180	161	96	207	139	114	....
1921.....	137	195	163	129	81	117	98	129	....
1922.....	185	228	95	114	116	109	98	135	....
1923.....	231	190	133	137	129	105	110	183	....
1924.....	185	190	98	170	166	141	107	147	143
1925.....	158	168	245	188	109	163	108	140	143
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	93	81	109	74	87	110
1938.....	69	196	80	83	76	64	57	97	88
1939.....	73	154	100	85	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	107	117	107	81	211	129
1942.....	153	369	168	136	143	124	91	202	163
1943.....	160	405	188	232	174	154	125	231	245
1944.....	167	420	214	219	170	160	138	234	212
1945.....	181	435	199	228	178	169	127	230	224
1946									
March.....	183	319	225	269	178	179	137	211	283
April.....	190	429	232	279	181	179	126	213	282
May.....	194	430	225	286	210	192	125	220	177
June.....	210	590	211	286	221	197	124	228	185
July.....	249	567	212	313	305	212	126	266	163
August.....	287	486	205	319	280	201	127	262	162
September...	285	488	184	255	269	202	130	256	154
October.....	304	530	175	238	266	213	136	293	151
November....	236	438	176	228	198	214	145	399	207
December....	242	435	181	239	190	217	149	406	166
1947									
January.....	240	390	185	351	188	216	147	401	238
February.....	246	319	188	260	192	225	147	391	275

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.59	5.16
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946						
March	1.75	1.42	7.81	5.77	4.86	6.71
April	1.75	1.42	7.81	5.77	4.86	6.71
May	1.75	1.42	9.08	6.10	4.86	7.30
June	1.88	1.42	10.34	6.42	4.86	7.90
July	1.88	1.42	11.62	8.15	5.34	9.60
August	2.22	1.46	16.88	8.14	6.07	12.14
September	2.22	1.46	10.32	6.95	6.07	12.14
October	2.22	1.46	13.20	7.12	8.30	12.14
November	2.22	1.46	15.19	11.26	12.14	12.75
December	2.22	1.46	14.63	11.37	12.14	11.17
1947						
January	2.36	1.46	12.98	11.06	12.14	10.32
February	2.41	1.46	10.02	11.06	12.14	10.17
Index Numbers (1910-14 = 100)						
1922	113	90	173	132	140	142
1923	112	102	177	137	136	147
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946						
March	65	50	223	163	144	191
April	65	50	223	163	144	191
May	65	50	259	173	144	207
June	70	50	295	182	144	224
July	70	50	332	231	158	273
August	83	51	482	231	180	345
September	83	51	295	197	180	345
October	83	51	377	202	246	345
November	83	51	434	319	360	362
December	83	51	418	322	360	317
1947						
January	88	51	371	313	360	293
February	90	51	286	313	360	289

Wholesale Prices of Phosphates and Potash **

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1922	.566	3.12	6.90	.632	.904	23.87	....
1923	.550	3.08	7.50	.588	.836	23.32	....
1924	.502	2.31	6.60	.582	.860	23.72	....
1925	.600	2.44	6.16	.584	.860	23.72	....
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.570
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946							
March	.650	2.20	6.40	.535	.797	26.00	.200
April	.650	2.20	6.40	.535	.797	26.00	.200
May	.650	2.20	6.40	.535	.797	26.00	.200
June	.650	2.30	6.45	.471	.729	22.88	.176
July	.650	2.60	6.60	.471	.729	22.88	.176
August	.700	2.60	6.60	.471	.729	22.88	.176
September	.700	2.60	6.60	.471	.729	22.88	.176
October	.700	2.60	6.60	.471	.729	22.88	.176
November	.700	2.60	6.60	.535	.797	26.00	.200
December	.700	2.60	6.60	.535	.797	26.00	.200
1947							
January	.700	2.60	6.60	.535	.797	26.00	.200
February	.700	2.60	6.60	.535	.799	26.00	.200
Index Numbers (1910-14 = 100)							
1922	106	87	141	89	95	99	....
1923	103	85	154	82	88	96	....
1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946							
March	121	61	131	75	84	108	83
April	121	61	131	75	84	108	83
May	121	61	131	75	84	108	83
June	121	64	132	66	76	95	80
July	121	72	135	66	76	95	80
August	131	72	135	66	76	95	80
September	131	72	135	66	76	95	80
October	131	72	135	66	76	95	80
November	131	72	135	75	84	108	83
December	131	72	135	75	84	108	83
1947							
January	131	72	135	75	84	108	83
February	131	72	135	75	84	108	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946								
March	209	187	158	97	57	175	121	78
April	212	188	160	97	57	175	121	78
May	211	192	162	99	57	189	121	76
June	218	196	163	100	60	203	121	70
July	244	209	181	103	60	230	121	70
August	249	214	187	116	67	293	131	70
September	243	210	181	108	67	223	131	70
October	273	218	197	115	67	286	131	70
November	263	224	198	127	67	382	131	78
December	264	225	204	127	67	376	131	78
1947								
January	260	227	206	126	69	359	131	78
February	262	234	209	123	70	329	131	78

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] **Since June 1941, manure salts are quoted F.O.B. mines exclusively.**

**** The weighted average of prices actually paid for potash are lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Feed and Fertilizer Laws," Div. of Foods and Dairies, Dept. of Agr., 39 South LaSalle St., Chicago, Ill., Sept. 1946.

"Fertilizers, Fertilizer Materials and Rock Phosphate Used in Illinois During 1945," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1300, March 1946, E. E. DeTurk.

"The Effect of Time of Application and Levels of Nitrogen, Phosphorus, and Potash on the Growth of Sugar Beets with a Detailed Statistical Procedure of Confounding in a 3x3x3 Design," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Tech. Bul. 203, June 1946, J. F. Davis, W. D. Baten, and R. L. Cook.

"The Storage of Nitrogen by Different Legumes," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 126, June 1946, I E. Miles.

"Nitrogen on Pastures," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Agron. Inf. Cir. 141, Feb. 1946, W. W. Woodhouse, Jr., R. L. Lovvorn, and D. S. Chamblee.

"Fertilizer Recommendations for Oklahoma Crops," Agr. Exp. Sta., Stillwater, Okla., Bul. B-305, Feb. 1947, H. J. Harper, H. F. Murphy, F. B. Cross, and H. B. Cordner.

"Inspection of Feeds and Fertilizers," Agr. Exp. Sta., R. I. State College, Kingston, R. I. Cont. No. 681, April 1946, C. H. Stetson, Jr. and R. W. Gilbert.

Summary of Fertilizers and Fertilizer Materials Sold in South Carolina, July 1-December 31, 1946," Dept. of Fertilizer Insp. and Analysis, Clemson Agr. College, Clemson, S. C., Feb. 25, 1947, B. D. Cloaninger.

"Commercial Fertilizers in 1945-46," Agr. Exp. Sta., Texas A & M, College Station, Texas, Bul. 684, Oct. 1946, J. F. Fudge and T. L. Ogier.

"Efficient Pasture Production Depends upon Systematic Application of the Proper Fertilizers," Agr. Exp. Sta., Logan, Utah, Mimeo. Series 327, June 1946, G. Q. Bateman.

Soils

"Soil Properties Contributing to Citrus Chlorosis as Revealed by Seedling Tests," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Tech. Bul. 112, Sept. 1946, W. T. McGeorge.

"Soil Management Practices in the Orchard," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Cir. Bul. 199, June 1946, T. A. Merrill.

"Rainfall and Irrigation in Relation to Soil Erosion," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 326, Dec. 1946, Willard Gardner, J. H. Gardner, and C. W. Lauritzen.

Crops

"Planning and Planting Field Shelterbelts," Dept. of Agr., Ottawa, Canada, Publ. 785, F.B. 139, Dec. 1946, John Walker.

"4-H Vegetable Gardening," Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Bul. 381, March 1946, O. S. Trask, J. R. Hepler, and E. S. Nodine.

"Winter Oats as Grazing for Beef Cattle," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., P. Bul. 627, Oct. 1946, G. B. Killinger, R. S. Glasscock, and W. E. Stokes.

"Performance of Corn Hybrids in Georgia," Exp. Sta., Experiment, Ga., P. Bul. 578, Jan. 6, 1947, G. A. Lebedeff.

"Asparagus Culture," Exp. Sta., Experiment, Ga., P. Bul. 582, Jan. 31, 1947, F. F. Cowart.

"Characteristics and Performance of Six Varieties of Cotton Tested in Middle and North Georgia During the Period from 1942 to 1946," Exp. Sta., Experiment, Ga., P. Bul. 583, Feb. 1947, W. W. Ballard.

"Grafting and Layering Citrus or Vegetative Propagation of Citrus Trees," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, T. H., Agr. Ext. Cir. 213 (Replacing Agr. Ext. Cir. 57), Feb. 1947, William Bembower.

"Fourteenth Biennial Report, 1945-1946," Dept of Agr., Boise, Idaho.

"1946 Illinois Hybrid Corn Tests," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 521, Jan. 1947, G. H. Dungan, J. H. Bigger, A. L. Lang, Benjamin Koehler, and R. W. Jugenheimer.

"Report of the Director for the Year Ending June 30, 1945," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., 58th A. R., Nov. 1, 1945.

"Extension Service in Maine Reports Busy Year," Ext. Serv., Univ. of Me., Orono, Me., Ext. Bul. 348, Nov. 1946.

"Cotton Variety Tests in the Yazoo-Mississippi Delta, 1943-45," Agr. Exp. Sta., Miss.

State College, State College, Miss., Bul. 435, May 1946, J. W. Neely and S. G. Brain.

"Grazing Beef Cattle on Winter-Growing Crops," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 125, May 1946, R. H. Means, Russell Coleman, and H. W. Bennett.

"Grafting Fruit Trees," Ext. Serv., Univ. of N. H., Durham, N. H., Ext. Cir. 267, April 1945, C. O. Rawlings and L. P. Latimer.

"How to Grow Salad Greens and Pot-Herbs in Winter," Ext. Serv., Univ. of N. H., Durham, N. H., P. Bul. 193, Dec. 1946, J. R. Hepler.

"Bright Leaf Tobacco Curing," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Bul. 346 (Rev.), June 1946, E. G. Moss and N. C. Teter.

"Science Serving Agriculture, Part I," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Biennial Rpt., July 1, 1944-June 30, 1946.

"Science Serving Agriculture, Part II," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Biennial Rpt., July 1, 1944-June 30, 1946.

"Strawberry Culture and Varieties," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla. Bul. B-304, Feb. 1947, G. F. Gray.

"Farm Forestry in Clackamas County, Oregon," Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Bul. 662, Feb. 1946, W. M. Fergerson.

"Tobacco Insects and Diseases, South Carolina," Ext. Serv., Clemson Agr. College, Clemson, S. C., Bul. 109, Jan. 1947, W. C. Nettles, H. A. McGee, J. M. Lewis, and J. R. Mattison.

"Citrus Orcharding in the Lower Rio Grande Valley of Texas," Agr. Exp. Sta., Texas A & M, College Station, Texas, Cir. 111, Oct. 1946, W. H. Friend.

"Cotton Variety Tests in Texas—1945," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1047, Nov. 12, 1946, D. T. Killough.

"Biennial Report, 1944-1946," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 327, Jan. 1947.

"Science Benefits Farmers," A. R., 1945-46, Agr. Exp. Sta., Blacksburg, Va., Nov. 15, 1946.

"Results of Hybrid Corn Yield Trials in West Virginia for 1946," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Mimeo. Cir. 58, Feb. 1947, J. L. Cartledge, R. J. Friant, R. E. Strosnider, R. M. Smith, and B. J. Patton.

"Report of the Secretary of Agriculture, 1946," U.S.D.A., Washington, D. C.

"Currants and Gooseberries, Their Culture and Relation to White-Pine Blister Rust," U.S.D.A., Washington, D. C., F. Bul. 1398, Rev. July 1946.

"Summer Crops for Green Manure and Soil Improvement," U.S.D.A., Washington, D. C., F. Bul. 1750, Rev. Jan. 1947.

"Crested Wheatgrass," U.S.D.A., Washington, D. C., Leaf. 104, Rev. Feb. 1947.

"A Pasture Handbook," U.S.D.A., Washington, D. C., Misc. Pub. 194, Rev. Sept. 1946, A. T. Semple, H. N. Vinall, C. R. Enlow, and T. E. Woodward.

Economics

"Arizona Agriculture, 1947," Agr. Exp. Sta., Univ. of Ariz., Tuscon, Ariz., Bul. 206, Feb. 1947, G. W. Barr.

"1945 Citrus Production Cost Study, Lemons & Grapefruit, San Bernardino County, including Ten Year Summary, 1936-1945," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"1945 Orange Production Cost Study, Navels & Valencias, San Bernardino County including Ten Year Summary, 1936-1945," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"1945 Lemon Production Cost and Management Analysis, San Diego County, California," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"1945 Valencia Oranges Production Costs and Management Analysis, San Diego County, California, Seven Year Average," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"Production and Marketing of Cowpeas for Canning," Exp. Sta., Experiment, Ga., Bul. 252, Dec. 1946, N. M. Penny.

"1946 Summary of Fruit and Vegetable Unloads at Honolulu and Shipments to the Mainland," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, T. H., Agr. Ext. Cir. 215, Jan. 1947.

"Illinois Farm and Home Outlook," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 609, Jan. 1947.

"Social Aspects to Land Use Planning in the Country-City Fringe: The Case of Flint, Michigan," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Sp. Bul. 339, June 1946, Walter Firey.

"Outlook for Fruits, Vegetables and Potatoes in 1947," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Pamph. 151, Jan. 1947, R. V. Backstrom.

"Cotton Production Costs in Northeast Mississippi, 1944," Agr. Exp. St., Miss. State College, State College, Miss., Bul. 429, Feb. 1946, W. J. Edens.

"Improving Farm and Ranch Tenure in the Northern Plains," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 436, July 1946.

"The Farm Business in Southeastern Nebraska, 1940-44," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Bul. 383, Oct. 1946, W. L. Ruden.

"Corn Production Requirements, Nebraska, 1944," Agr. Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. C. 840, Sept. 1946.

"1947 Farm Production Prospects in Oklahoma," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Mimeo. Cir. M-163, Nov. 1946.

"Oregon's Farm Price Data, 1909-1944,"

Agr. Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Bul. 660, Dec. 1945.

"1947 Recommended Production Adjustments in Agriculture in South Dakota," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Agr. Econ. Pamph. 21, Aug. 1946.

"Preliminary Report on Agricultural Production Adjustments for Utah for 1947," Agr. Exp. Sta., Logan, Utah, Mimeo. Series 329, Aug. 1946.

"Agricultural Statistics, 1946," U.S.D.A., Washington, D. C.

"The 13th Annual Report of the Farm Credit Administration, 1945-46," U.S.D.A., Washington, D. C.

"Handbook on Major Regional Farm Supply Purchasing Cooperatives, 1944 and 1945," Farm Credit Adm., U.S.D.A., Washington, D. C., Misc. Rpt. 102, Sept. 1946, J. G. Knapp and J. L. Scearce.

Fertilizer by Airplane?

"Distributing fertilizer by airplane should not be entirely disregarded," commented Glenn A. Cumings of the U. S. Department of Agriculture, in discussing recent and rapid advances in fertilizer equipment and suggesting others likely to come. Mr. Cumings is a senior agricultural engineer in the Department.

"Even though to date the practice has not come into much competition with the use of conventional agricultural machines," he continued, "it seems reasonable to predict that airplane equipment will be more extensively used. But fertilizing from the air is likely to be under conditions which will not materially change the need for conventional machines, at least in the near future. It is likely to be a supplementary use, not a substitute use."

Fertilizers for Sugar Beets

(*From page* 10)

with oxidation processes in the soil. The season of 1945 was very cold and wet during the period of early growth. As shown by the data in table 4, increases in yield as a result of spray applications of 5 pounds of manganese sulfate amounted to 1 ton per acre on the Kuschinsky farm and 1.9 tons on the DuRussell farm. These treatments in 1945 were made on July 30. Earlier applications might have been even more beneficial.

Manganese sulfate may be purchased in fertilizer in Michigan at three different rates—100, 200, and 300 pounds per ton of fertilizer. It is recommended that the farmer purchase a quantity which, according to his rate of application of fertilizer, will apply between 25 and 50 pounds of the manganese sulfate per acre. Thus, if he plans to apply 300 to 500 pounds of fertilizer per acre, he should buy fertilizer containing 200 pounds of manganese sulfate per ton.

Boron Is Still Necessary

Farmers should not become careless and omit borax from their fertilizer. Boron is so essential as a nutrient for sugar beets that all sugar beet fertilizer should contain enough to make the application of borax somewhere between 8 and 10 pounds per acre.

Boron is essential in the production of new growth tissue. When it is not

Fig. 5. Sugar beet deficient in boron but one which has not developed the dead heart. Note the small twisted leaves and the cross-checked leaf petioles.

present in sufficient concentration, the new cells disintegrate and growth is greatly hindered. Serious deficiency symptoms are most likely to occur on strongly alkaline soils. The symptoms are noticeable from late July until harvest time, first as dead hearts and abnormally shaped leaves. The leaves may be curved because of restricted development on one side, and the upper sides of the petioles are often cross-checked. An unusually large number of

Fig. 6. Sugar beet roots from plants deficient in boron. The left portion was from a plant which had grown sufficiently to cover the dead heart. The other pieces were from beets which had almost normal tops, where the starvation for boron was indicated by the darkened tissue and external root cankers.

small leaves may be formed around the dead heart. The root tissue of deficient plants often, but not always, contains darkened areas and zones where the cells have disintegrated to form cankers. Such roots are low in sucrose content. Figures 4, 5, and 6 illustrate some of the symptoms of boron starvation.

Borax is recommended in all sugar beet fertilizers and may be purchased in Michigan already mixed in fertilizers at the rates of 50, 100, and 200 pounds per ton. The grower must select the rate which, considering his desired rate of fertilizer application, will give him the 8- to 10-pounds per acre application of borax. Somewhat more than 10 pounds of borax may be applied without danger of injury if it is not applied directly with the seed.

The Search for Nutrient Deficiencies in Farm Crops

(*From page* 26)

most of the common economic plants. Such conditions as strong acidity or alkali in the soil can be easily spotted, however.

Greenhouse trials with soils variously treated and growing different kinds of plants have been helpful in spotting deficiencies. We have found it helpful to use a small quantity of soil (about a pound), supply all elements other than the one that is being checked for deficiency, and grow an indicator crop such as sunflowers to spot deficiencies and to indicate the nutrient supplying power of the soil for the different essential elements.

By this method, enough plant growth can be obtained in eight to twelve weeks to determine what nutrient elements are most deficient in the soil. The method works better when nutrients are added to the soil in solution to stimulate quick growth, making perhaps three applications at intervals of a week or two during the growth period of the plant. By applying a liberal quantity of the essential elements except the one under study, the capacity of the soil to supply the one element is pretty well tested. One trial with a series of enough different treatments is sufficient to check the supply of all essential elements for any one soil and crop.

There are, of course, limitations to this method. The choice of an indicator crop offers a problem, in that there is a wide difference in the response of different crops growing on soils that are variously treated. What is adequate for one crop may be a deficiency for another, and it is not possible to test all crops in the greenhouse. Some plants, such as trees, are too slow growing for a quick greenhouse test.

The final test for nutrient deficiency and response to treatment is always a field trial, where the normal plant environment functions to influence the response. In the field the physical properties of the soil, the moisture supply, temperature, sunshine, and other things may become a major influence governing crop yield. Field responses, therefore, are not necessarily quite the same as previous study in the laboratory and greenhouse might lead one to predict.

Greenhouse results do give a valuable indication which should be followed up in the field. We first tracked down boron deficiency with greenhouse trials and sunflower as the indicator plant. Borax was then used in the field as a source of boron, first on cover crops with no measurable response. But when used in walnut orchards, on some soils the response to boron was phenomenal. In a few

cases enormous yields of walnuts were obtained where only light crops or nothing had been obtained before the borax was used. On filberts there has been no measurable response to boron up to the present time. Boron deficiency has been found for a number of other crops, however.

In field trials reliable indications can be obtained from small plots, a few feet of row, or a few trees, before large scale treatments are made. Such trial treatments should be liberal to bring out distinct effects quickly. Economic rates of fertilization can be determined only after it is discovered what deficiencies exist and what corrective measures are needed.

After a number of preliminary trials with borax on walnuts it was found that the response was good, after two or three years, on some soils. On other soils there would be no response. Several carloads of borax have been used by walnut growers, but principally by those who have good reason from tree symptoms, or small scale trials, to expect good results. Up to 10 pounds of borax per tree at one application on big walnut trees has given good results. The same application on other more sensitive plants, however, might prove injurious. Such heavy applications probably should not be repeated two years in succession, even on walnuts.

Deficiencies of some of the minor elements—iron, zinc, manganese, and copper—are often best corrected by the use of suitable spray materials applied to the foliage or branches.

Deficiencies That Are Most Common

While both the crop and the soil must be evaluated in designating deficiencies, it is usually possible to make some general recommendations. For most Oregon soils, the humus level is sufficiently low that provision for humus renewal and nitrogen fertilization is a necessity for obtaining improved yields. In our orchard fertilizer program, nitrogen deficiency is so outstanding in many orchards that no other treatment will give a response until the nitrogen deficiency is corrected. This usually means enough fertilizer to supply 50 to 100 pounds or more of nitrogen an acre. The response is sometimes as much as 50 per cent or more increase in yield by the third year of treatment.

Phosphorus deficiency is common for those crops with high phosphorus demands. The same is true of sulfur. Gypsum is especially effective when used on legumes. Potassium may be deficient on some soils for certain crops. In Eastern Oregon, there is some well-established zinc deficiency on cherries. A satisfactory corrective for all these deficiencies is known, though not always adequately practiced. Scarcity and high prices of agricultural products result in renewed interest in corrective measures for all types of nutritional disturbances that reduce the yield or impair the quality of the crop. The use of fertilizer has recently been greatly increased.

A well-planned fertilizer program will seldom be limited to the correction of one nutrient deficiency. For example, the use of nitrogen fertilizer may increase the yield sufficiently to cause other deficiencies, not present with small yields, to appear. On valuable crops, some of which return several hundred dollars an acre, it is considered good insurance to use a complete fertilizer, supplying not only the usual N-P-K but also sulfur and in many cases boron where there is a probable deficiency. The wise use of a complete fertilizer is likely to result in soil improvement whereas the use of nitrogen only may deplete the soil fertility.

Maximum yields so far as the soil is concerned will be obtained from the correction of nutrient deficiencies where the physical properties are good. Loams, silt loams, and sandy loams that are deep, permeable, well-drained, aerated, and oxidized are favorable. The ideal structure will be sponge-like,

enabling the soil to absorb and hold moisture for plant growth. Perhaps only irrigation can adequately regulate the moisture for maximum yields. A deep root zone is important in irrigation practice, but is doubly important where there is no irrigation and the crop must survive long drouth periods drawing only upon the stored moisture in the deep soil.

When the physical properties of the soil are good and moisture is adequate, the well-planned fertilizer program produces both satisfaction and good returns. No kind or amount of fertilizer can compensate for shallow depth, impervious clay-pans, poor aeration, and lack of moisture storage in the soil. An adequate diagnosis, which will lead to profitable increases in yields from the right kind of treatment must fully evaluate all these yield factors, recognizing also that disease, insect enemies, and other things influence yields and may become the controlling factor if not corrected.

Rice Nutrition in Relation to Stem Rot of Rice

(*From page* 14)

son with the nitrogenous fertilizer cannot be measured wholly in terms of yields since severe stem-rot lodging, such as occurs when only nitrogenous fertilizers are applied, lowers the quality of rice and makes harvesting difficult.

The results of experiments conducted in the greenhouse and at the Rice Branch Station, Stuttgart, Arkansas, confirm earlier observations that rice susceptibility to stem rot is influenced by host nutrition. High levels of nitrogen increase susceptibility whereas high levels of potassium reduce susceptibility. The results are sufficiently promising to warrant fertilizer tests on outlying rice farms where stem rot is known to cause severe losses.

TABLE 3.—EFFECT OF FERTILIZERS ON LODGING AND YIELD OF RICE, STUTTGART, ARKANSAS—1946.

Variety	No fertilizer		400 lbs. 10–0–0 July 5		400 lbs. 10–4–10 July 5	
	Percentage of plants lodged [1]	Bushels per acre yield [1]	Percentage of plants lodged [1]	Bushels per acre yield [1]	Percentage of plants lodged [1]	Bushel per acre yield [1]
Zenith	0.0	36.3	0.0	52.3	0	55.1
Prelude	6.0	36.4	9.0	49.2	3.5	54.0
Arkansas Fortuna	17.5	31.6	34.0	42.3	12.5	42.7
Nira	26.5	27.6	39.0	45.1	25.5	48.9
Mean	12.5	32.9	20.5	47.2	10.4	50.2

N=Cyanamid, P=superphosphate, K=potassium sulphate.
[1]Average of four replications.

The Effects of Fertilizers on Blackland Soils of Texas

(*From page* 12)

ably the phosphate applied affect the exchange capacity. On all the soils potash was recommended. After the phosphate need is met, potassium may become the limiting fertilizing element.

Tests on other soils of Texas have shown that almost identical yields of the succeeding crop have been received from applying fertilizers to the legume, and from applying it directly to the crop. If a balanced soil nutrient level is obtained for winter legumes on Blackland soils, the question of how to fertilize the Blacklands may be answered.

Don't Feed Alfalfa at the "Second Table"

(*From page* 22)

"Legumes are soil renovators in a marked degree and may be very profitably employed in building up run-down soils. Without legumes the problems of maintaining adequate supplies of organic matter and nitrogen in soils are difficult; with legumes they are simple." These statements are partly true but are misleading, for the soil is not enriched in the numerous plant-food nutrients other than nitrogen.

Since nitrogen was the nutrient element that usually became the first limiting growth factor in the poor upland soils of the Corn Belt region before phosphorus, potassium, and calcium became limiting, the increase in crop yields following the legumes led to the common interpretation that the legumes were soil-building in a broader sense than they actually are. Furthermore, it has been found that legumes are efficient producers of extra nitrogen only when all conditions, as inoculation, drainage, soil acidity, and the supply of minerals such as phosphorus, potassium, calcium, and magnesium, are adequate.

The benefits derived from deep-rooted legumes like alfalfa are not to be minimized since they do pull minerals out of the subsoil. Neither should it be minimized that the organic residues are beneficial in numerous respects; but farmers should know that alfalfa is a tremendously heavy feeder for phosphate and, particularly, potash. In table 5 a comparison is made between alfalfa and several other common crops to indicate the quantities of phosphate and potash used or removed by the crops. It is apparent that alfalfa can be extremely hard on the land if the crop is removed as hay and the phosphate and potash not adequately returned in the form of manure or crop residues.

If alfalfa and other legumes are to be fed at the "second table," it is obvious that the second table must supply adequate plant-food nutrients. The practice of adding extra phosphate and potash as fertilizer with the small grain where legumes are to be seeded is a very sound practice. It must be emphasized, however, that these extra quantities will need to be higher than those commonly used if high yields are to be expected.

During the spring of 1941, alfalfa plots were established on a low-fertility Crosby silt loam near Lafayette. All treatments were applied in triplicate. Analysis of this soil for available potash

TABLE 4.—AVAILABLE POTASH, EXPRESSED AS POUNDS K_2O PER ACRE EIGHT INCHES, FOUND IN VARIOUS DEPTHS OF SOME COMMON UPLAND FOREST SOILS OF INDIANA.[1]

Soil type	Depth in inches	No. of samples	Lbs. K_2O per acre 8 inches
Cultivated soils [2]			
Clermont silt loam	0–8	5	138
	13–20	2	165
	28–36	2	182
Crosby silt loam	0–8	4	163
	13–20	2	269
	28–36	2	152
Crosby silty clay loam	0–8	2	229
	13–20	2	346
	28–36	2	247
Miami sandy loam	0–8	2	132
	13–20	2	129
	28–36	2	138
Vigo silt loam	0–8	2	123
	13–20	2	255
	28–36	2	261
Virgin soils [3]			
Alford silt loam	1–9	1	201
	13–20	1	232
	28–36	1	237
Cincinnati silt loam	1–9	1	301
	13–20	1	149
	28–36	1	275
Clermont silt loam	1–9	1	301
	13–20	1	213
	28–36	1	288
Frederick silt loam	1–9	1	264
	13–20	1	264
	28–36	1	208
Zanesville silt loam	1–9	1	280
	13–20	1	261
	28–36	1	288

[1] Available potash extracted with neutral normal ammonium acetate.
[2] Analyses on cultivated soils from unpublished data by the authors.
[3] Analyses on virgin soils from unpublished data by Roy Weaver, assistant in agronomy, A.E.S. Purdue University.

indicated a very low supply, 160 pounds per acre eight inches, in the surface soil and considerably more, 270 pounds per acre eight inches, in the subsoil. The plots were well-limed and 1,000 pounds of 20% superphosphate and 200 pounds of muriate of potash separately and in combination were broadcast before plowing and turned under. The seed was properly inoculated to insure nitrogen fixation. No yields were taken the first summer, but plant-tissue tests indicated that the young alfalfa might be able to utilize even more fertilizer, especially potash. Therefore, an additional 500 pounds of the superphosphate and 200 pounds of the muriate were top-dressed on the plots in the fall.

Yields for the 1942 season, table 6, show that the plot supplied with both phosphate and potash in addition to lime yielded 4.35 tons per acre compared to 2.04 tons where lime alone was used, 2.48 tons for lime + potash, and 3.38 tons for lime + superphosphate. The value, at 1942 prices, of the phosphate and potash applied to the plot with lime, phosphate, and potash treatment was $27.75, with muriate of potash worth $45 per ton and 20% superphosphate $25 per ton. It may be seen that the 2.31 tons increase in hay from this plot over the plot receiving lime alone would need to sell for only

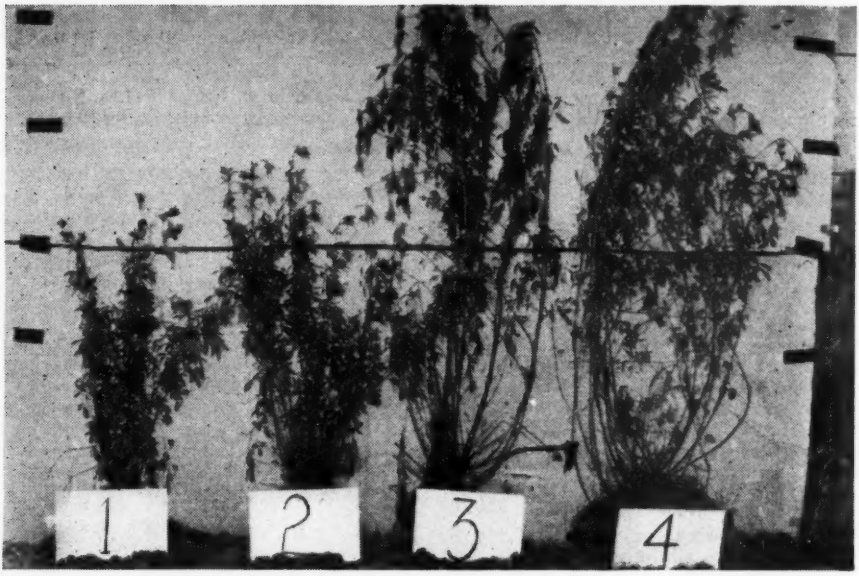


Fig. 2. Alfalfa from various fertilizer treatments on a low-fertility Crosby silt loam near Lafayette, Indiana, first cutting 1942. Treatments are as follows: (1) No treatment; (2) lime alone; (3) lime + phosphorus + potash; (4) lime + phosphorus.

$12 per ton to pay for the fertilizer used. Good alfalfa hay was selling for substantially more than that in Indiana in 1942. The entire cost of the fertilizer cannot be assigned to the first year's production since the fertilized plot will undoubtedly continue to outyield the plots without balanced fertilization or with no fertilization. Evidence of this is indicated by the extent to which weeds and grass have already reduced the stand on the latter plots and thus decreased the quality of the hay.

The importance of applying adequate fertilizers in the most effective manner in establishing stands of legumes on low-fertility soils and in the prevention of injury due to freezing and thawing in winter cannot be over-emphasized since the young seedlings must

TABLE 5.—PHOSPHORUS AND POTASH CONTENT OF SOME INDIANA CROPS, EXPRESSED AS POUNDS PER ACRE P_2O_5 AND K_2O BASED ON AVERAGE YIELDS 1930-39.[1]

Crop	Average yield 1930–39 [2]	Phosphorus		Potash	
		% P_2O_5	Lbs/acre P_2O_5	% K_2O	Lbs/acre K_2O
Alfalfa hay	1.69	0.44	14.9	1.33	45.0
Clover hay	1.10	0.43	9.5	1.54	33.9
Corn	36.2	0.55	10.8	0.40	7.8
Oats	26.0	0.91	7.8	0.92	7.9
Soybean (grain)	16.6	1.40	13.9	1.60	15.8
Tame hay (Timothy)	1.15	0.46	10.6	2.19	50.4
Wheat	17.6	0.95	10.0	0.51	5.4

[1] Per cent composition of phosphorus and potash for the various crops taken from Purdue Bulletin 468 by Lucas, Sieling, and Scarseth.

[2] Yields from Indiana Crops and Livestock Estimates No. 206, 1942, and expressed in bushels or tons per acre according to crop.

TABLE 6.—YIELDS OF ALFALFA HAY IN TONS PER ACRE, FROM VARIOUS FERTILIZER TREATMENTS ON A LOW-FERTILITY CROSBY SILT LOAM NEAR LAFAYETTE—1942.

Treatment	Yield of hay in tons per acre
Untreated	1.92
Lime alone	2.04
Lime+400 lbs. muriate of potash	2.48
Lime+1,500 lbs. 20% superphosphate	3.38
Lime+1,500 lbs. 20% superphosphate+400 lbs. muriate of potash	4.35

1,000 pounds of the superphosphate and 200 pounds of the muriate of potash were broadcast and plowed under before seeding and the remainder was top-dressed on the young alfalfa the following fall.

feed entirely from the surface soil until their roots become established in the subsoil. In some soils in Indiana the supply of phosphate and, particularly, potash is higher in the subsoil than in the surface soil. Once deep-rooted legumes are well established they can utilize some of these nutrients.

Evidence of this is shown by the yield of the plot, table 6, to which lime and phosphate but no potash had been applied. Here the yield was considerably higher than early growth would have indicated due to a supply of potash in the subsoil. However, many soils in Indiana have lost this reserve of plant nutrients through continued cropping, especially with legumes, and here the application of adequate fertilizers is particularly important.

Fertilizer Practices for Profitable Tobacco

(*From page* 17)

acre more than for the 28 plots not mixed.

Provided the fertilizer is thoroughly mixed before listing, the 1,500-pound applications are most profitable, but if the 1,500-pound applications are not mixed then they are much less profitable than the 1,200-pound rates or the 900-pound rates with side-dressing added.

Comparison of the three different side-dressings used would indicate that those containing 2½ pounds borax per acre produced average acre increases of about $90 to $100 over the 900-pound fertilizer applications without a side-dresser while the commercial 5-5-20 (which probably contained no borax) gave average increases of only about $75 per acre, or $15 to $25 less gain. (The difference in nitrogen content could have accounted for some of this difference in values.) When used following 1,200 pounds per acre fertilizer application and with 20-inch spacing, the side-dressing still gave a $28 per acre increased value. This would indicate that side-dressings containing nitrogen, potash (practically free of chlorine, and in the approximate proportion of two units of potash for each unit of nitrogen), and a small amount of boron (2½ pounds of borax per acre) pay handsome dividends where tobacco has received original fertilizer applications of only 900 to 1,100 pounds per acre and smaller profits where 1,200 pounds and more per acre of fertilizer were used.

The most profitable treatment in this experiment was the 1,200-pound application of 3-9-6 when mixed in the furrow before listing, plants spaced

20 inches in rows, and 100 pounds of 8-0-16 plus borax side-dressing used. This combination gave two-year average yields of 1,563 pounds with average values of $819 per acre.

The replants needed per acre were, on the average, approximately double where the fertilizer was not mixed in the soil before listing.

Summary and Conclusions

On typical bright tobacco soils fertilizer applications account for approximately 75% of the tobacco yields and acre values.

Average farm fertilizer practices produce, at present tobacco prices, average income values fully $100 to $150 per acre less than improved practices would give.

Twelve hundred to 1,500 pounds of 3-9-6 fertilizer per acre produce tobacco yields and values much larger than 900 pounds of fertilizer, provided the heavy rates of fertilizer are thoroughly mixed in the furrow before listing the land.

Fifteen hundred pounds of fertilizer per acre when not mixed are less profitable than 1,200 pounds, or 900 pounds plus 100 pounds of side-dresser. For normal applications of fertilizer the 20-inch spacing in 4-foot rows seems about right and is recommended.

Replants needed can be reduced by one-half by mixing the fertilizer in the furrow before listing previous to transplanting, or by using a machine to place the fertilizer in bands to the sides of the plant roots. A combination machine of this type designed and built by the writer in 1946 gave excellent results. The fertilizer distributor and row-lister were built around the chassis of an ordinary stalk cutter and resulted in a very low-cost, dual-purpose machine which saved approximately 75 per cent of the labor and team costs usually required to do these jobs. It produced results in tobacco yields and acre values never before equaled on this Station.

Two and one-half pounds of borax per acre applied either in the original fertilizer or in a side-dresser 20 days after planting give average increased acre values of $25 to $30 and are recommended.

Community Improvement Contests

(*From page* 24)

and improvement of soil fertility and feed production; 100 on development and improvement of appearance of home and farm; 100 on conveniences and liveability of home and farm; 400 on community organizations and development.

Practically the same outline is used in the contests sponsored by the Chattanooga and Nashville groups. The Plant-to-Prosper contest is based more upon individual accomplishments.

Are the results justifying the efforts and prize money? More scattered examples of the work done show that one community took as a major project the elimination of all but registered bulls on the farms of that community; another organized an unique recreation program; many built community houses; one community sponsored a State farm tour in search of better farming practices; another concentrated on reclaiming farm lands; one encouraged G. I.'s to enter farming and to develop sound farming systems. There is no full count at hand now of the schools and churches assisted and improved, the buildings painted and repaired, or the tons of fertilizer used. A few individual examples will show what this amounts to on a statewide basis.

Leaders of the Buffalo community in Grainger County sat down in January and made their plans for the year.

They listed all individual and community farm problems, and needed home improvements. Chairmen were appointed to push each phase of work. The dairy chairman checked on herds, pastures, and production; the Four-H Club leader checked on that work; and the field crops chairman worked accordingly. County and home agents were called in for advice on how to meet farm and home objectives.

As a result, Buffalo was practically self-supporting in the matter of feed, reducing the amount of hay bought by 92.5 per cent, and the amount of other feeds bought by nearly 75 per cent—this, despite a healthy increase in the number of work stock, beef cattle, dairy cows, hogs, sheep, and poultry. It was done through increases of 9 per cent in small grains, 14 per cent in winter legumes, 40 per cent in alfalfa, and good increases of other home-grown feeds and pastures.

This community noted that 91 per cent of its families grew and conserved 75 per cent or more of their food needs. In addition to the home food supply, families filled hundreds of jars and cans for the school's hot lunch program. Buildings were painted, lawns seeded, fences built, home equipment bought, ad infinitum. Multiply this by about 400 competing communities, over the State, and the result reveals the actual progress made.

It is obvious that each community had plenty to do, since the judging was to be on improvement over the year before. Prosperous communities had no better chance of winning than less prosperous ones. Barren Plains, a well-to-do Robertson County community, reported the replacement of scrub bulls with registered sires. Barren Plains also constructed a community playground, fully lighted, and equipped for all ages.

Twin Oaks, in Putnam County, among other things furnished labor and materials to improve the school grounds, putting a good road through the premises. Twin Oaks leaders also saw to it that all barns and outbuildings were painted. A half-dozen eroded and practically waste farms were put back into cultivation.

Problems differed almost as widely as there were contestants. For example, Berry, a Wayne County community, started the shift from straight cotton with no winter cover, to a point where practically every cotton acre is in vetch. Alfalfa and small grains also were given impetus.

Then there is the prosperous community of Van Leer, in Dickson County. This group emphasized kitchen improvement and started a community cannery.

Everywhere, home improvements have been high on the list. The total adds up to a lot of communities which are now better places in which to live. It is anticipated that even more will be accomplished through the State in 1947.

Making It Safer to Save

(*From page* 5)

bountiful citrus groves at a bargain.

And of all these cruel temptations that beset a wallet-bulging yokel the least of them was not a hunger for land. Indeed the inner instincts of the native son of the soil cleaved to the lust for the land which many generations before his time had bred into those bucolic bones. It took a mighty lot of rapid-fire talking by those worthy bond brigades to stop some of those land expansion hankerings and wring the necks of

the buzzards who proposed such investments. They failed in many cases, too, and their failure in due turn may be followed by the financial failure of the witless ones who bit on accustomed bait, forgetting the debacle of the depression days.

TOO few folks have taken time out to study the savings bond issues which the Treasury has sold to the credit of other than the commercial banking institutions. The first of these were the series A and B bonds, issued in 1935 and 1936, with the usual maturity in 10 years. They amounted to a trifle over one billion dollars in value and reached maturity in 1945 and 1946. This year the third, or C series, reached maturity.

The value of the whole series from C through G, or five separate issues, amounted to $67,979,000,000 of sales. Of this series of five issues only $17,636,000,000 have been redeemed by holders. This means that the Treasury still retains over $74 of every $100 originally invested by citizens out of the string of five issues aforesaid.

Taking the commonly popular series E issue, the amount which had been sold through January 31 of this year totaled about $45.8 billions, of which the redemptions were reported at that date as being $15.3 billions. Holders cashed in for only 33.4 per cent of their original investments, leaving the Treasury with 66.6 per cent of the investment intact.

It is also interesting to note that Series E, F, and G bonds were first offered in the spring of 1941, since which time to January 31, 1947, over $64 billions had been sold. This means that at least one-tenth of the national income has gone into this form of investment during the five-year period.

In confidential figures gathered by the Treasury a list of states with high rank in regard to low redemptions of series E bond issues presents illuminating facts. The high point in the list is where total bond sales stand at 165 per cent of the respective redemptions. The low point marks the spot where bond-holders of Series E bought only about 80 per cent of the amount they cashed.

Without breaking any seals of confidence, we can state that the big farm states of the Midwest, such as the Dakotas, Nebraska, Iowa, and Kansas maintain a unique position of merit in respect to their low rate of redemptions compared to purchases of savings bonds. I suppose someday when a final analysis can be taken of the reasons for and against retaining government issues snug in the strong-box, we shall get vital human documentary evidence that shows the interplay of economic forces. No doubt some of the low rate of redemption can be explained by a better financial reserve enjoyed by the ones best able to hang onto their wartime savings. Too many farmers went into the war price boom without the necessary fat on their ribs to help them withstand a long siege. It was a comfort to them at any rate to know that the cash they tucked under the teller's window to buy a savings bond was theirs for the asking, with a little mite of intrinsic value added.

WHILE the interest which is paid by the government on those valuable savings bonds is not huge and tempting to the rural thrifty, it is more than offset by the security involved through dealing with Uncle Sam. The reason that the interest is not very high is a story in itself. In spite of the existence of a present national debt which is 100 times the size of the Civil War Debt and 10 times that of the burden we bore collectively back in the first world war, the rise in the interest which must be paid to lenders by Uncle Sam is only about 37 per cent larger than it was after the Civil War. In funding the existing debt our government possessed powers and privileges through the Federal Reserve System that enabled us to borrow money at a low rate of interest, whereas 8 to 10 per cent

interest was charged when the government was weak and uncertain of success back in the colonial times.

But when it comes to paying interest on farm land the answer is not so clear. At least there is some evidence that the rates are not down as far relatively as those the government accomplished in its own interest reduction process. Activity in the real estate market for farm properties located in nine counties of the Southeast region has been studied. The sales values for the last half of the past year were over 10 million dollars, compared to about 6 millions in 1945 and only 3 millions in 1941.

Speculation was going on, too. In this survey it was noted that 13 per cent of all the sales were of land owned less than two years by the purchaser, while two-fifths of the sales had been made within six months of original purchase, and at an apparent gross profit on resales of 36 per cent. That is, the speculators paid about $45 an acre and sold it within 6 months for $65 an acre.

IN that same region, typical of the area in general, fully 60 per cent of all land sales were made for cash. The rest were on credit and usually mortgaged for just about as much as the same land would have sold for in 1941. Interest rates varied from 3 to 10 per cent, with fully 20 per cent of the mortgages being based on rates 7 per cent and higher.

If a recession happens along unawares and dips the level of farm prices considerably below the velvet margin where ordinary folks without much skill and experience or ability can mosey along, somebody will get burned badly on skyrocket land values.

Meanwhile the neighbor who has whittled away on his farm without indulging in expansionist dreams and has laid aside some profits in the form of government bonds, or maybe some needed capital improvements or labor-saving equipment, is surely sitting in an easier seat, come what may.

JUST because the proclamation ending hostilities has been made is hardly sufficient reason for any of us to become prodigal of our financial resources and begin to run amuck, any more than to cringe and be afraid to make a reasonable amount of progress. This goes for personal affairs as well as for public welfare.

The nation spent something like $330 billions to save ourselves from defeat and misery. In doing so we lost more than 300,000 men on whose lives no price may be estimated. We also pay for disabled veterans and their educational and occupational benefits, billions for further defense and security, and a tremendous sum for interest. If we answered the roll call readily when the fighting was going on and signed up for our quota of government bonds with alacrity, then it is nonetheless vital for us to keep on investing in post-war recovery.

Along with the current bond buying must go a concerted attempt to enlist our best minds and strongest purpose in support of the United Nations charter and all the brave visions of world peace that caused the international councils to be organized—in agriculture as well as in trade. Unless these seemingly altruistic programs finally bear fruit, the long-time worth of any kind of investment, public or private, will diminish.

How fine it would have been had we been able to sell bonds for needful public works and highways and similar progressive and peaceful improvements, instead of beating the bushes to induce folks to shell out for making war and paying for it afterwards.

Lately an editor figured out what this country might have done with the $330 billions spent in war and defense. He claims that if we paved every mile of unimproved roads and alleys in the country at a cost of $50,000 per mile, it would have cost $79 billions, leaving $251 billions in the balance.

We could then give every auto owner a new car at $1,500 apiece and that would cost $52½ billions more, leav-

ing $198½ billions in the kitty. We could give each GI and his wife a trip over to the scenes of his former triumphs abroad, and at $2,000 a trip this would leave us $178½ billions to spend.

What is more astonishing, we could build a public hall or museum in every city with 25,000 or more population equal to the big marble Supreme Court edifice in Washington, and at a $4-billion bill for it, our swag would still be $174½ billions. We might also erect a $10-million hospital in every place of 5,000 or more, expend $30 billions in so doing, and have $144½ billions in the cooler. Then, if we wanted to be real nice, we could give a $50-per-week pension to every person over 60 years old at a total cost of $3½ billions annually and then take 41 years of that to use up what was left in the war budget.

ONE wonders, however, if we could engender the same degree of enthusiasm for bond pledges to do such things as that as we succeeded in doing for the all-out offensive in wartime.

In conclusion, the attitude of our educational and extension agencies toward proper safeguards in savings is significant and reassuring. Four basic things to do so as to insure the future reasonably well have been emphasized often in literature and lectures by such agencies: (1) Pay unsecured debts as soon or as fast as possible; (2) Reduce farm mortgages to amounts that can be easily carried in a possible depression; (3) Make only necessary investments in machinery, buildings, and equipment to cut costs and improve efficiency; and (4) Put surplus funds into United States savings bonds.

By putting your nest-egg into safer savings through the reliable Federal bond issues, much aspirin and anacin will be left on the drug-store shelves.

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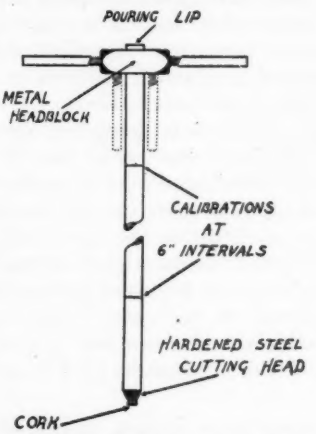

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THE AMERICAN POTASH INSTITUTE

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A saiesman taking his bride South on their honeymoon visited a hotel where they boasted of their fine honey.

"Sambo," he asked the colored waiter, "where's my honey?"

"Ah don' know, boss," replied Sambo, eyeing the lady cautiously, "she don' work here no mo.' "

* * *

A precocious three-year-old floored his parents the other day with his remark: "I'm getting t-i-r-e-d as h-e-l-l of your spelling words around me all the time!"

* * *

The tramp had just finished his repast and the lady of the house remarked: "Just as a suggestion, there's a woodpile in back."

"You don't say," said the tramp. "What a splendid place for it."

* * *

Today I met a friend of my youth who used to be an ardent socialist, filled with visions of reforming the world. He says he never got over it until he married and found how difficult it is to change just one woman.

* * *

He: (At the movies) "Can you see all right?"

She: "Yes."

He: "Is there a draught on you?"

She: "No."

He: "Is your seat comfortable?"

She: "Yes."

He: "Change places with me, will you?"

Sophomore: "Did you ever take chloroform?"

Freshman: "No, who teaches it?"

* * *

The Department of Taxation received a typed income tax return from a bachelor who listed one dependent son. The examiner returned the blank with a penciled notation—"This must be a stenographic error." Presently the blank came back with the added pencil notation, "You're telling me!"

* * *

She was insulted when somebody offered her a drink, but being a lady, she swallowed the insult.

* * *

Sympathy is what one girl offers another in exchange for details.

* * *

A man is getting along in years when he pays more attention to the food than he does to the waitresses.

* * *

The Seven Ages of Woman: The infant, the little girl, the miss, the young woman, the young woman, the young woman, the young woman.

* * *

A somewhat drunk G.I., hailed before his commanding officer, offered this excuse: "I got into bad company. I had a quart of whisky and my three buddies didn't drink."

Need for—

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